Electrical Contracting

THE MAGAZINE OF ELECTRICAL CONSTRUCTION & MAINTENANCE

MARCH - 1946

Residential Wiring

illight



Helps minds at work!

It's the construction of G-E ballasts that helps keep fluorescent fixtures quiet.

The distracting effects of ballast hum won't plague the employees of your customers—nor build up your complaint file—if your fixtures are equipped with G-E ballasts. Noise is built out of the G-E ballasts at the same time that long life is built in.

Constructed to exacting standards, the G-E ballast typifies G-E engineering in the various phases of fluorescent lighting. The finest low-loss core steel is uniformly rolled, stamped, and stacked as part of the controlled quality construction. Machine winding produces rectangular solid coils and eliminates "springy" layers, while a special sealing compound fills every void and seals the components to one another and to the ballast case.

The clamping frame is designed to prevent shifting of parts and resulting noise. Wiring is made easy by the angle slot construction which lets leads out at either ends or bottom. You can thus use one case style for many different mountings.

The G-E trade mark on fluorescent lighting equipment signifies the best that engineering skill and quality manufacture can produce. And remember, there is a G-E component for *every* lighting requirement. The next time you have a lighting problem, call in your local G-E representative. Our complete facilities are at your service.

Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

General Electric ballasts help keep fixture users satisfied—they mean added profits for you

- 1 Low noise level—for satisfied users
- 2 Long life for low maintenance cost
- 3 Characteristics matched with lamp —for rated lamp life and light output

BALLASTS LAMPS STARTERS
LAMPHOLDERS CABLE
for DEPENDABILITY in fluorescent lighting



GENERAL ELECTRIC



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A practical technical and management journs for electrical contractors, and strial electricians, inspectors, engineers and motor the s, covering engineering in allation, repairing, mattern ce and management is the cld of electrical construction and maintenance.

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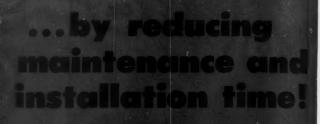
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Throws Off in Heat?

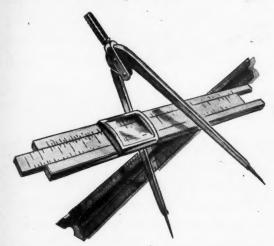
Our Navy Did...on fleet tugs down in the tropics, where engine room temperatures were running high as 140°F!
In 25 by 30 ft of space, that's like having 140, thousand-watt radiant heaters "raising blisters" on you all at one time!



Here's How Navy Figured: To get 765 shaft hp out of 94% efficient propulsion motors, of which there are four aboard, they were putting in about 812 hp of electrical energy. Or, 47 hp went in that didn't come out of the shaft, but escaped through the frame. This ran about 35 kw heat per motor.



Well, Our Temperatures Began To Rise when Navy laid down its 'specs'. "Design a marine water-cooled motor—make it fit into the floor space of your open drip-proof type—no major changes in ship design. Make it extra-dependable, as fireproof as practicable".



We Measured, and figured, and made designs—used a new, toxic gas-free Glass Melamine insulation that required extensive changes in design and fabrication. We put special air passages inside the motor—yet kept accessibility. We saved 25% space over our previous commercial marine design by figuring a special shape cooler—without cutting down cooler efficiency.



Then We Made Those Motors Shock-Proof — by cutting out all cast iron, re-designing structural members for greater strength, resorting to modern, proven fabrication throughout. Result: A new kind of water-cooled motor that put a "tough" Navy job on ice, and also proved a point!



There's a Point to this story: Every time Allis-Chalmers engineering discovers new ways of solving special motor problems, like this one, it also learns how to build better standard motors for you! Watch for these new and better motors from A-C. Allis-Chalmers, Milwaukee 1, Wis.



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COMPLETE T&B KIT

FOR THE MAN WHO HOOKS UP SMALL WIRES

Contains everything you need: A liberal supply of standard T&B Sta-Kon* Pressure Terminals** for wire sizes #22 through #10, and the simple T&B streamlined Installing Tool.

This Assortment Kit assures quick, safe, neat wiring jobs in the shop or on location. No solder. No fuss. No muss. T&B Sta-Kon Terminals are engineered to make perfect electrical

and mechanical connections. Approved by Underwriters Laboratories and U.S. Government. Millions were specified for battle-wagons, bombers and other critical war uses.

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First mass-produced during the war for U. S. fighting ships, these new Allis-Chalmers Class "B" Insulated Dry-Type Transformers overcame critical weight and space limitations.

Today, incorporating these same warproved advantages, they're being produced for industries, utilities — to bring you simpler, safer and cheaper power distribution — new, long transformer life . . . at no advance in price!

For complete details, get in touch with your nearby A-C dealer or district office — or send today for new descriptive bulletin B6382. Allis-Chalmers Mfg. Co., MILWAUKEE 1, Wis.





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NO OTHER DRY-TYPE TRANSFORMER GIVES YOU ALL THESE 6 MONEY-SAVING ADVANTAGES...

These new 80° C rise class. "B" insulated transformer weigh 22% to 38% less than the old 55° C tiss units, take fawer, lighter mountines.

2 Up to 1/2 Sension!
The new design of these transformers also results in smaller overall size. That means easier handling for workers, quicker, cheaper installation.

A Greater Safety!

No liquid to test, filter or change; nothing to promote combustion. Result: no fireproof vaults needed — you get safer installation inside buildings.

S. Languer Life!

New class "B" insulation used in these transformers affords greater protection against moisture — won't deteriorate with age won't stretch or shrink!

6 Same Low Prices!
Yes, you can buy the new, improved class "B" insulated dry-type transforment for the same prices as prdinary class "A" insulated units.

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Gentlemen:

Please send me your Bulletin B6382 describing the new line of Dry-Type Transformers,

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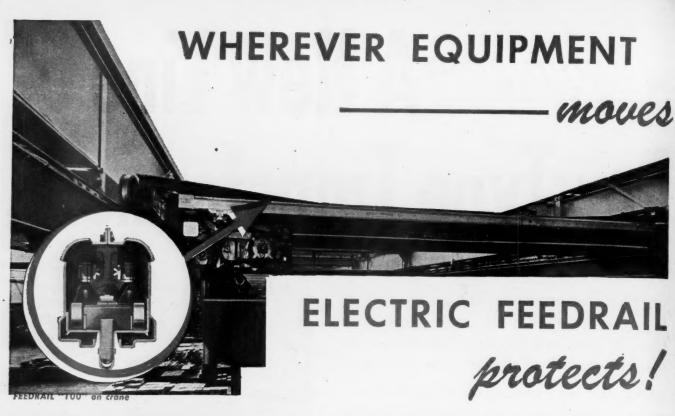
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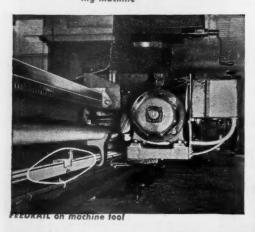
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ing machine



Whenever you see exposed wires on a crane system, wires on the floor or awkward motions of portable tool operators — think of FEEDRAIL.

CRANES AND HOISTS

Electric Feedrail is an enclosed bus bar system having movable trolleys that make contact with the bus bars at all times. It is polarized, fused and grounded and each section carries the Underwriters' Label.

FEEDRAIL is protected against dust, mechanical injuries and mechanical shorts. It is furnished in assembled sections and curves. Also available for Slide Switches and transfers. Easy to install, inspect and service.

PORTABLE TOOLS

FEEDRAIL not only feeds but also supports all types of portable tools which may be readily disconnected by means of fused EVER-LOK connectors.

TEST RACKS

or any electrical equipment that has to be moved or rearranged to accommodate new production layouts is best served by FEEDRAIL.

ASK FOR FEEDRAIL CATALOGS GENERAL No. 15, NEEDLE TRADES No. 16, MACHINE TOOL No. 17

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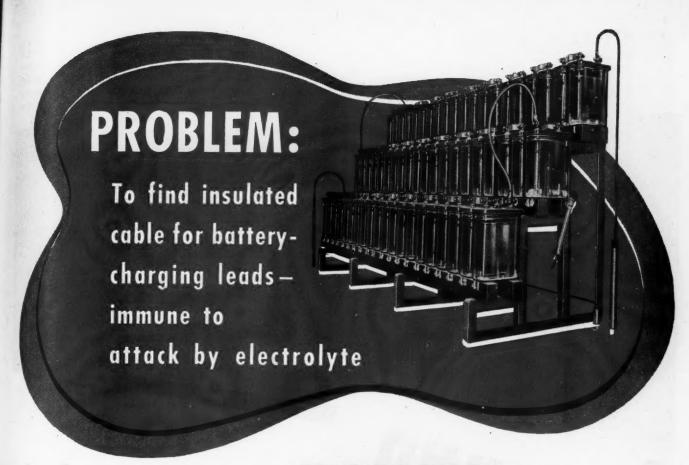


FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company

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SOLVED WITH FLAMENOL CABLE

An Ohio steel mill required insulated cable for its battery-charging equipment, which consisted of a 250-kw generator and a 27-panel switchboard. Cable was needed for leads from panels to batteries. As the leads ran underground, the cable insulation had to withstand moisture as

is

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well as electrolyte fumes and accidental contact with the electrolyte itself. Four years ago, at G.E.'s suggestion, Flamenol* Style FL insulated cable was selected for the job. The mill reports that the original installation is still giving trouble-free service.

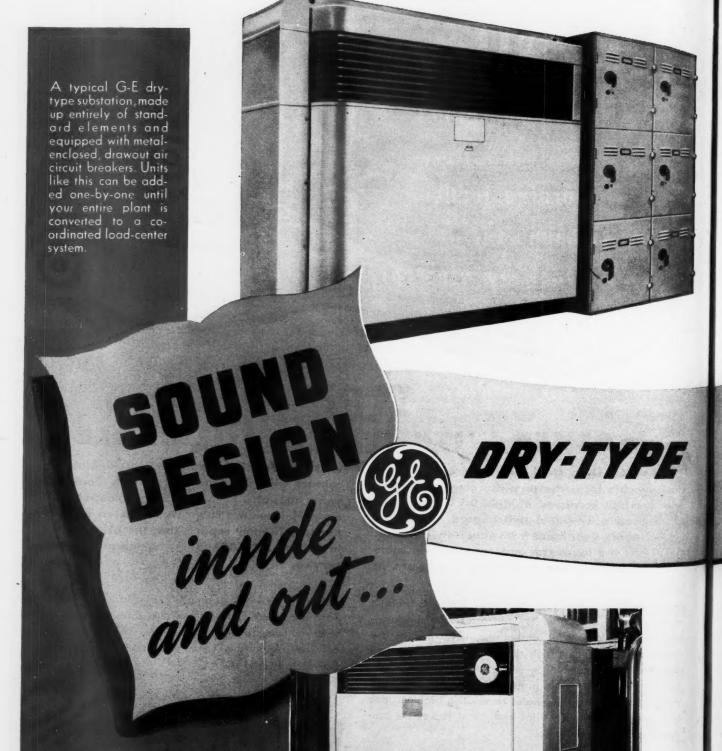
RESISTS CHEMICALS—Flamenol Style FL cable is highly resistant to oils, water, mild acids, and alkalies—and weather. It is tough and stable, is flexible at low temperatures, and has high dielectric strength. Flamenol does not support combustion—therefore, prevents outages due to fires. Requiring no protective braid, it reduces the volume of wiring and eliminates terminating problems due to fraying. Its insulation strips easily and leaves the conductor surface untarnished.

A G-E "FIRST"— Only G.E. makes Flamenol cable. Flamenol is the original cable insulated with plasticized polyvinyl chloride. G.E. introduced it in 1935—not as a substitute for rubber-insulated cable but as a new type

GENERAL & ELECTRIC

possessing desirable properties not obtainable in rubber. To find out how Flamenol can help solve your problem—save you time, trouble, and expense—ask our local office, or write Apparatus Dept., General Electric Company, Schenectady 5, N. Y.





A "bright spot" anywhere in the plant, this G-E dry-type load-center unit substation (150 kva) is completely self-contained, incorporating high-voltage potheads, disconnecting switch, fuses and low-voltage thermal breakers.

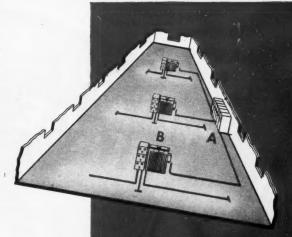
G-E dry-type unit substations are styled to meet 1946 requirements for neatness and clean-cut appearance in your plant equipment-layout. Their design simplicity lends itself to ease of location and facility of installation. Their light weight reduces structural problems.

Users who prefer dry-type equipment will find these unit substations at the top of their class in their ability to handle overloads. For, the transformer sections of G-E dry-type unit substations are designed to meet AIEE Standards No. 1 for Class B insulation, with 130 C maximum hot spot temperature in a maximum ambient of 40 C. They also meet ASA Standards C-57.1, which limit the observable temperature

These unit substations have factory-matched switchgear -that is, the interrupting capacity of the switchgear section is matched, electrically, mechanically, and thermally, with transformer characteristics.

G-E dry-type unit substations are repetitively manufactured. This is a feature adding to their flexibility, for as load requirements change, expansion is met by the addition of similarly matched units, block by block. Thus, a planned efficient load-center power distribution system is always in operation in your plant. G-E dry-type unit substations are available in ratings up to 2000 kva, 15,000 volts.

Ask for bulletins GEA-3592A and GEA-3714B. Call your nearest G-E representative or write to Apparatus Dept., General Electric Company, Schenectady 5, N. Y.



In a modern load-center distribution system, power is distributed from metal-clad switchgear (A) at relatively high voltage (2.4 to 13.2 kv) to load-center unit sub-stations (B) located near the centers of electrical load areas. There it is stepped down to utilization voltage (below 600 volts) and distributed to the load through short secondary feeders.

UNIT SUBSTATIONS



G-E dry-type unit substations have been supplied in quantity since early in the war-construction period, and sizes and types to meet individual load conditions can now be ordered right out of the catalog.



The terminal compartment casing extends down the entire side of the substation, facilitating cable entrance connections. The unit can be moved into place after conduit and cable have been made up. On vital conversion jobs, this convenience feature will save many precious hours.

THE RIGHT AT THE RIGHT OF THE THE RIGHT OF THE PLACE

It's surprising how many places there are around a factory where close voltage regulation can improve processes or working conditions. All five regulator installations shown here, for example, are paying their way at one typical plant—probably similar to yours in many of its operations.

In planning more efficient electrical usage, be sure the right voltage is right where you want it. General Electric's full line of feeder voltage regulators—large and small—manual and automatic—can meet any problem where volts or kilovolts must "toe the line". And your local G-E office can deliver whatever technical aid you need to apply them to the job. Apparatus Dept., General Electric Co., Schenectady 5, N. Y.

These dry-type induction voltage regulators are used to control temperature of a wire-annealing operation. Twelve strands are processed simultaneously, each regulator acting to control the current-flow through series-connected sections of two conductors. These hand-operated regulators make it easy to adjust for different conductor sizes and other changes in operating conditions.





2 Smooth, stepless voltage control for 100,000-volt testing equipment is provided by this 5-kva dry-type induction voltage regulator. Connected in the primary (low-voltage) side of the step-up transformer, this regulator affords 100 per cent raise-and-lower regulation, so that output test voltage can be varied from 0 to 100 kv, simply by turning the crank.

.PAYS OFF 5 WAYS AT A SINGLE PLANT

USING G-E VOLTAGE REGULATORS

Electric heating circuits on a hot-rolling press used to fabricate laminated plastic forms are maintained at the required temperature with induction voltage regulators. Circuits for two electrically heated rollers and one hot plate are separately controlled by the hand-operated regulators, giving close control of processing.

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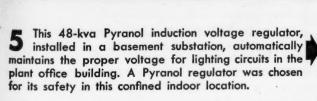
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Automatic voltage regulation by means of this drytype induction regulator has "paid off" in a more uniform level of illumination. The full visual value of every kw-hr is obtained with fewer lamp burn-outs from overvoltage. Production space is saved by locating the regulator on a platform along with the Pyranol* transformer which serves the lighting circuits.

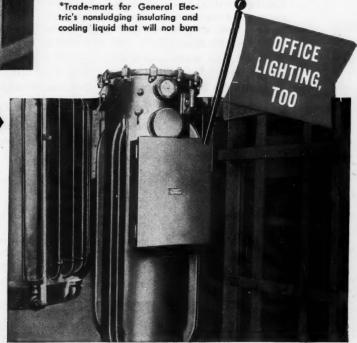


For complete information on any of General Electric's voltage regulation equipment, write for the following publications:

Oil-immersed Induction Voltage Regulators—Type IRS GEA-2018 (24 kva and smaller) GEA-2985 (36 kva and larger)

Pyranol Induction Voltage Regulators—Type IRS, GEA-3443 Dry-type Induction Voltage Regulators—Type AIRS, GEA-3057 Inductrols (Small Dry-type Induction Voltage Regulators) GEP-238

Automatic Voltage Stabilizers GEA-3634 Variable-voltage Autotransformers GEA-3635

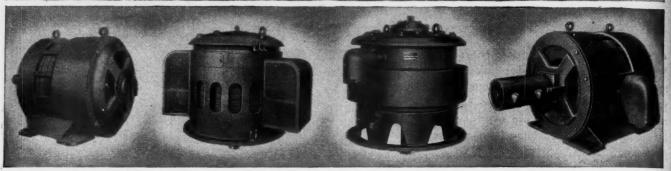


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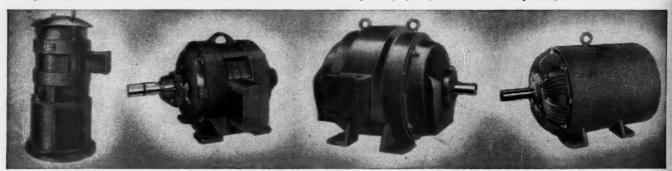
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THERE'S ONE CORRECT INDUCTION MOTOR that best fits into your plant



- 200 Hp. Induction Motor
- 400 Hp. Vertical Ind. Motor
- 200 Hp. Squirrel Cage Vertical
- 300 Hp. 4-Speed Squirrel Cage Ind. Motor

- 25 Hp. Vertical Ind. Motor
- 250 Hp., 1800 r.p.m. Ind. Motor
- 30 Hp. Splash-proof Ind. Motor
- 40 Hp. Fan Cooled Ind. Motor



BURKE INDUCTION MOTORS assume all kinds of types and sizes to meet specific conditions. They may be Squirrel Cage, with normal torque—normal starting current; normal torque, low starting current; high torque, low starting current or high torque, high slip. They may be Wound Rotor with constant or varying speed.

They may be multi-speed, drip and splash-proof, enclosed, enclosed fan cooled, vertical, flange, round frame and in sizes from 1 to 1500 H. P.

Consult with Burke engineers for that correct high quality induction motor designed for the job-

For a description of the complete Burke line of AC and DC motors and generators, consult Sweet's Engineering catalogs or Electrical Buyers Reference catalog.

For immediate assistance, telephone our nearest representative:



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Previous purchasers will be glad to know DIRECLITE can be easily installed for use with their present equipment.

Only Better Electrical Wholesalers distribute Officer and Direclite Units. There is a Leader Representative in your area. See him today, or write

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light diffuser for fluorescent lamps

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- Ideal for Factory, Office, Store and Home Lighting
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FLUOR-O-SHIELD is adaptable wherever exposed fluorescent lamps (40 W and 20 W) are used. Snap-on clips permit instant attachment or removal without bolts, screws or tools. Simply snaps on. Reduces eye-strain, results in improved work and efficiency. Improves appearance of all open lamp fixtures. Will not cast shadows. Does not catch dust or dirt.

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Available in two sizes: 40 watt, 20 watt. Order today! If your distributor does not have stocks, ask him to write us.

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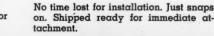
SPECIFICATIONS:

Catalog No.	Length	Fits Tube	Units per Pkg.	Color	
27-1-40	48-in.	40 watt	12	White	
27-5-40	24-in.	20 watt	12	White	

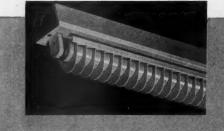
*Trade Mark—Patent Pending

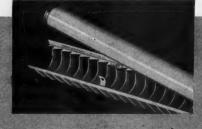
No glare from any angle. FLUOR-O-SHIELD casts no shadows.

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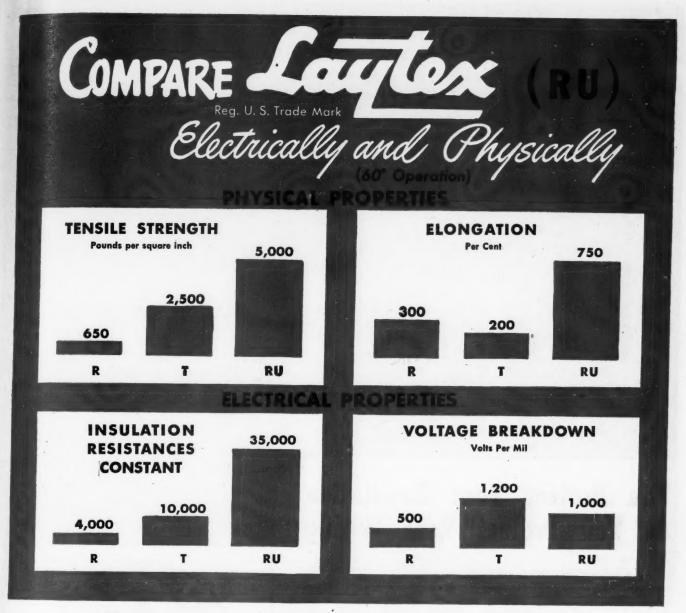
20 Watt - 24-inc







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THREE TYPES of building wire are authorized under the new Electrical Code. These are:

R—Used by the Industry since its inception. The copper conductor has a Code rubber insulation and fibrous overall cover.

T—A copper conductor with VINYLITE (a synthetic compound) insulation.

RU—LAYTEX. This type has a copper conductor, natural rubber insulation and fibrous cover.

The charts above show the wide margin by which LAYTEX leads in physical and electrical qualities. This is America's lightest weight, smallest diameter, natural rubber covered wire. Now available without restriction.

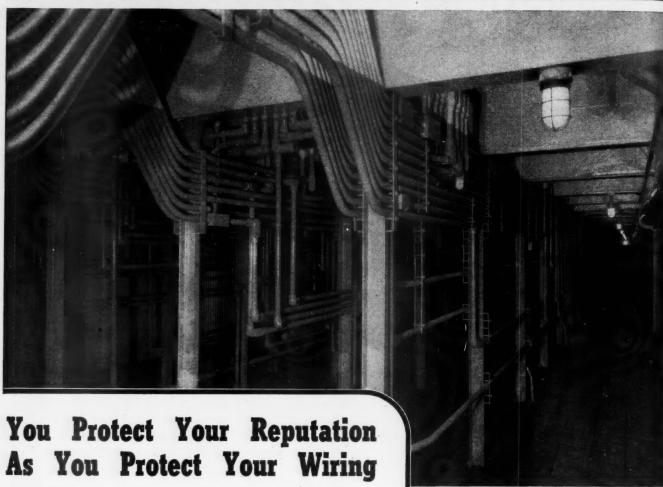


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Nothing Insulates like Rubber

UNITED STATES RUBBER COMPANY

1230 AVENUE OF THE AMERICAS . ROCKEFELLER CENTER . NEW YORK 20, N. Y.

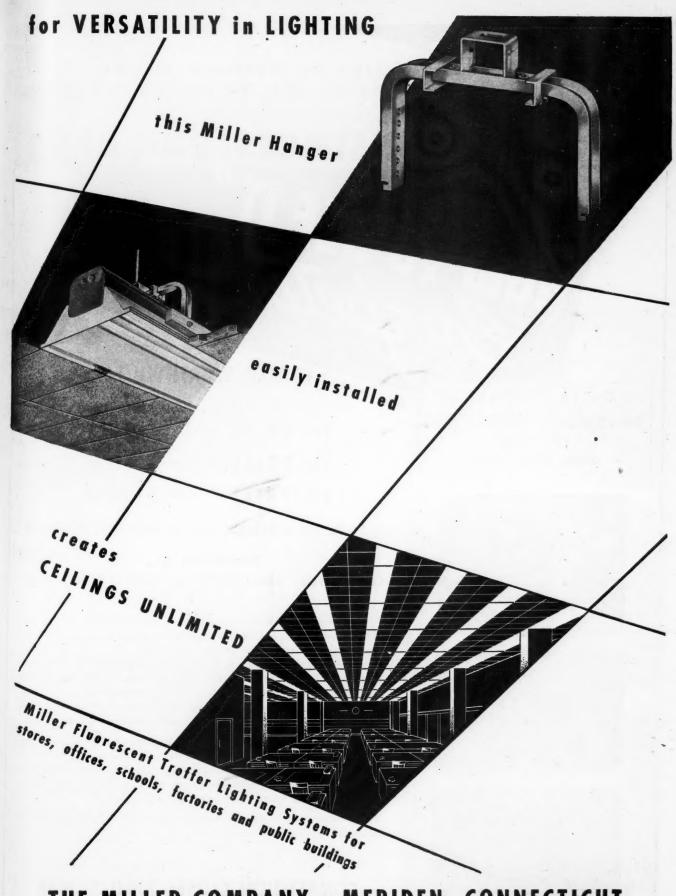


 ${f A}_{ ext{MERICANS}}$ judge a man, a machine, or a wiring job by performance-performance not just today, but tomorrow, and for a lifetime.

Recent shortages made necessary certain emergency practices that do not meet the high standards of the National Electrical Code...as in the use of conduit. As every contractor knows, the only code-approved wiring system, designated as moisture-, vapor-, dust-, and explosion-proof, for use in hazardous locations and occupancies is a standard-threaded, rigid steel

Now, as you rewire for modernization and wire new buildings, you can use Youngstown Buckeye Conduit-the full-weight, rigid steel which for many years has been first choice of contractors and customers alike. Whenever you use Buckeye you give your wiring the best possible protection. Likewise you protect your own reputation for safe methods and sound practice.





THE MILLER COMPANY . MERIDEN, CONNECTICUT

ILLUMINATING DIVISION

Fluorescent, Incandescent Mercury Lighting Equipment

46

ROLLING MILL DIVISION

Phosphor Bronze and Brass in Sheets, Strips and Rolls FOUNDRY DIVISION

Non-Ferrous Metal Castings HEATING PRODUCTS DIVISION

Domestic Oil Burners and Liquid Fuel Devices



A REMINDER . . .

TIME IS GETTING SHORT SEND US YOUR ENTRY Now

WIREMOLD BUSINESS-BUILDERS



TYPICAL EXAMPLES OF WIREMOLD INSTALLATIONS

. WIN FOR YOU .







· REALLY WORTHWHILE PRIZES

• 1st. PRIZE • • • \$500.00

. 2ND. PRIZE . . . \$250.00

• 3RD. PRIZE • • • \$100.00

\$25 PAID FOR ALL ENTRIES USED IN WIREMOLD PROMOTION

OPEN TO ALL CONTRACTORS AND ELECTRICAL MAINTENANCE MEN

Today...and in the near future...you are planning many jobs using Wiremold Raceways and Fittings in war plants, hospitals, schools, stores, offices and other types of buildings. All of these jobs are interesting to us and many of them will point the way to future Business-Building opportunities for you and your fellow electrical men. That is why we are announcing this Wiremold "How to Use it" competition... to record the best of these Wiremold applications for the benefit of all. Send now for folder giving full details of how to enter, and the few simple rules.

Awards will be made for those installations judged as showing business-building possibilities in a wide field, as well as good judgment in the selection and use of our products, bearing in mind the wide adaptability and interconnectability of Wiremold in completing the wiring system "FROM PANEL BOXES TO OUTLETS".

The judges shall be chosen from the electrical industry, and their decisions shall be final.

COMPETITION CLOSES APRIL 1, 1946

THE WIREMOLD COMPANY, HARTFORD 10, CONN.



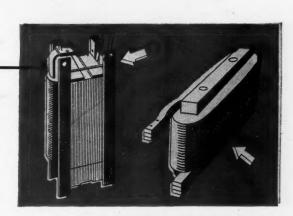
LEADERS in internal curing

NSULATING ARNISHES

For Transformers

IRVINGTON #100

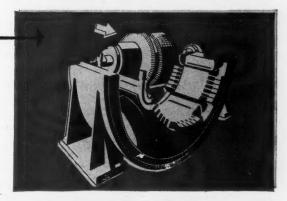
A clear internal drying varnish noted for long-life at high temperatures. Life test of over 1100 hours at 105°C. Thorough penetration and curing is obtained even in the deepest windings. Provides firm, though flexible, transparent bonding, so clear that coded leads are readily identified. Possesses excellent electrical properties, and is oil, acid and moisture resistant.



For Motors

HARVEL #512C and 612C

Phenol-aldehyde type varnishes derived from Cashew Nut Shell Liquid. Set dry throughout by heat induced chemical polymerization, thus cannot leave gummy half-cured interiors. Provide high insulation resistance at all temperatures, and are outstanding in this feature at operating temperatures up to 300°F. Extremely resistant to acids, alkalis, moisture, and oilproof.

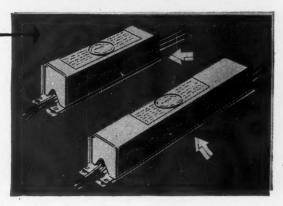


For Fluorescent Transformers and Ballasts

HARVEL #612C

Now widely used by Fluorescent Ballast manufacturers, because the unique structure of this cashew varnish aids greatly in keeping ballasts hum-free.

All the above varnishes will cure most satisfactorily under conventional convection baking methods, or infra-red. For complete information write Dept. 46, Irvington Varnish & Insulator Company, Irvington 11, New Jersey.



RVINGTON Varnish and Insulator Company

Irvington 17, New Jersey, U.S.A.....





LIKE THE IRON

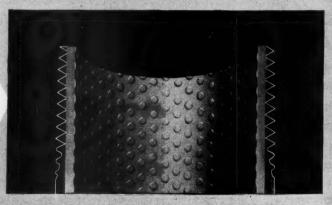
Electrical Raceways

No threads to cut... no lines to turn... when you use convenient, modern ELECTRUNITE E.M.T. This simple compression-type fitting is quickly and easily tightened with only a pair of pliers.

Lightweight, modern ELECTRUNITE E.M.T. requires no excess metal to serve as a base for thread-cutting. Without threading operations, no base metal is exposed to corrosion and finish is undamaged by wrench marks.

Every length of safe, modern ELECTRUNITE E.M.T. carries the Underwriters' Laboratories label of approval—your assurance that this up-to-date conduit has been inspected for adequate electrical and mechanical protection.









ELECTRUNITE E.M.T.—the Streamlined Raceway Combines Convenience and Light Weight with Safety

Convenience . . . light weight . . . safety . . ; these are three important reasons why more and more electrical contractors prefer to use Republic ELECTRUNITE E.M.T. Consider these facts:

CONVENIENCE

ELECTRUNITE E.M.T. is threadless. Hence it eliminates tedious thread-cutting. Two simple compression-type fittings — easily tightened without turning the tubing—make strong, watertight joints that will not work loose. Inch-Marking*—an exclusive ELECTRUNITE development, consisting of easy-to-read inch and foot marks on every length—greatly increases cutting and bending accuracy.

LIGHT WEIGHT

Because it requires no excess metal to serve as a base for thread-cutting, ELECTRUNITE E.M.T. is much lighter than ordinary threadedtype conduit. Thus it is easier to handleespecially in cramped, hard-to-reach or overhead installations.

SAFETY

The wall thickness of ELECTRUNITE E.M.T. was not arrived at by guesswork. It was carefully and scientifically determined by Underwriters' Laboratories as being adequate to provide necessary electrical and mechanical protection throughout the system. Moreover, ELECTRUNITE E.M.T. is approved by the National Electrical Code for exposed, concealed and concrete slab construction.

Yes, consider these facts—add the many other advantages of ELECTRUNITE E.M.T.—and you, too, will agree that you can't beat this modern electrical raceway. For complete information, see your ELECTRUNITE Distributor, or write to:

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION - CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.



Electrical Contracting, March 1946

Unlimited uses! Unlimited SALES **OPPORTUNITIES IN** LAU "NITEAIR" **EXHAUST FANS**



5 Diameter Sizes of 8 Discharge Capacities

Everyone wants comfortable, refreshing sleeping, working, and shopping conditions. Lau "Niteair" propellertype fans provide more real, long-term comfort than anything that could possibly be devised or procured on such small investment. Installed in homes — large or little - Lau fans expel daytime heat; replace it with fresh, cool, night air. They have many practical applications besides homes - in offices, stores, restaurants, factories, commercial buildings, and others. Mass manufactured in straight line production for low-cost competitive selling. Sales are a snap. Profit potential, great.

> Write us direct . . . or contact your jobber



Exhaust hot air. Pull in cool, fresh air.



Remove musty, stale air from storers

HUNDREDS OF APPLICATIONS

Here are a few-

Air-conditioning shops and offices Removing dust-laden air in factories Removing foul or contaminated air Preventing dangerous fume penetration (from one shop to an or from shop to office)
Removing smoke from furnace rooms
Spot-cooling foundry workers

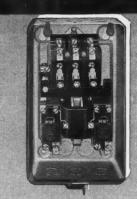


Engineers and fabricators of general Air Handling Equipment • Single Inlet and Double Inlet Blowers • Propeller Fans • Accessories

LONG LIFE and LOW MAINTENANCE are Built into "3C" Bulletin 6013 AC MAGNETIC STARTERS

Bulletin 6013 Non-Reversing, Across-the-Line Starters are designed to provide full voltage starting and overload protection for squirrel cage motors, and can be used as primary switches for wound rotor-induction motors. They offer the following "built-in" features:

- 1. Double break, silver-to-silver contacts.
- 2. Motor overload protection provided by eutectic alloy thermal overload relays.
- 3. Starter assembly mounted on steel sub-panel.
- 4. Hinged armature magnet.
- 5. Buttons in cover provide for externally resetting overload relays.
- 6. Non-carbonizing arc shields.
- 7. Form-wound operating coil.
- 8, "Start" and "Stop" buttons available in cover.
- 9. Ample space for wiring.
- 10. Entire assembly easily removed.
- Il. Heavy drawn steel or cast enclosures.



Bulletin 6013, Size 1. Form MA Starter in NEMA Type 1 Enclosure.



Bulletin 6013, Size 2, Form MA Starter in NEMA Type 1 Enclosure.

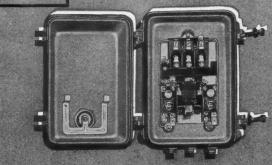
HAMMERHEAD MAGNET PROVIDES HIGH SPEED CLOSING WITH

MINIMUM IMPACT

This close-up view of the magnet shows why the Bulletin 7700 contactor used in these starters gives extra long life. The single pivot point has a nitralloy pin and bushing. Moving armature is light weight, and travels only a short distance—resulting in high-speed closing with minimum impact. Riveted magnet laminations prevent internal motion.

"3C" Bulletin 6013 Starters are available in a wide variety of sizes and cabinets to meet every requirement.

*Our Distributors and District offices will welcome your inquiries.



Builetin 6013, Size 1, Form MA Starter in NEMA Type 4 1C50-43 water-light enclosure. Also Available in NEMA Type 5 1C50-28 dust-tight and NEMA Type 7 enclosure for Class 1, Group D, hazardous locations.



THE CLARK CONTROLLER CO.

1146 EAST 152nd ST., CLEVELAND 10, OHIO . EVERYTHING UNDER CONTROL



HERE'S AN Extra

THAT'S EASILY SOLD

FOR EVERY NEW HOME!

More and more women are discovering the convenience of built-in telephone facilities. Persons who are planning to build new homes can easily be sold on the advantages of installing rigid or flexible conduit, at time of building, to carry telephone wires between the walls.

Why not get additional business on every residence job by including a bid for built-in telephone facilities? It helps to sell the house and pleases customers.

• No electrical contract is really complete unless it includes built-in conduit and outlets for telephones.







For Rural Electrification Jobs:

Weatherproof outdoor re-

Entrance fittings—sill plates—gasketed elbows—cable heads—reversible service fittings—ground clamps.

Waterproof outdoor switch housings.

Weatherproof lights.
Ceiling and wall lights

Yardlights.

Weatherproof conduit

Standard threaded and thin wall type conduit bodies.
Conduit fittings and insulated knockout covers.



Your county and almost every county in the entire United States is enjoying many miles of new power lines being projected by the REA. That means many, many new wiring jobs for the electrical contractor with a complete line of rural electrification fittings — The Killark Line is a COMPLETE line of REA fittings. The electrical contractor who concentrates on the Killark Line is especially qualified for REA jobs because he can be supplied with every fitting he needs and the proper fitting — from his Killark wholesaler.













Send to Killark for Rural Electrification Bulletin—you need this information for REA jobs.

ELECTRIC MANUFACTURING COMPAN'

Offices and Warehouses: Atlanta, Baltimore, Boston, Chicago, Denver, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Seattle and Syracuse.
Offices: Cincinnati, Cleveland, Dallas, Detroit, Kansas City, Minneapolis.

Vandeventer & Easton Ave. SAINT LOUIS 13, MO.



One order to Wagner brings everything needed to meet your exact transformer and switchgear needs—a complete unit substation engineered as a single unit, fully backed with undivided responsibility by Wagner.

Wagner unit substations are easy to install—and when future load changes so dictate, easy to move intact to a new location.

In addition to (1) ease of ordering, (2) undivided responsibility, (3) simplicity of installation and (4) ease of relocation, Wagner unit substations offer you such other important advantages as (5) less installation expense, (6) maintenance is simplified, (7) low-voltage feeders are shortened, (8) less manpower needed to make changes, (9) built of the highest-quality materials in accordance with the latest engineering practices.

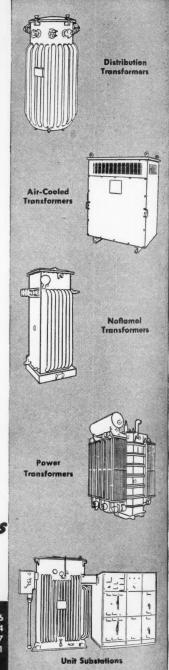
Get acquainted with entire Wagner line of distribution and power transformers. Ask for Bulletins TU-180 and TU-181, gladly sent on request addressed to Wagner Electric Corporation, 6413 Plymouth Avenue, St. Louis 14, Mo.

Other Wagner Products for Industry: Air Brakes • Brake Lining • Electric Motors • Hydraulic Brakes • Industrial Braking Systems • NoRoL • Tachograph

Consult Wagner Engineers on all Transformer Problems

Wagner

Sales and Service Branches: ATLANTA 3 • BALTIMORE 18 • BOSTON 15 • BUFFALO 8 • CHICAGO 16
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Take your time, lieutenant . . . this GOLD SEAL's got a good grip on him

Other Jenkins Bros. tape products include Diamond Seal Friction and Rubber Tapes, which meet ASTM and Federal specifications.

Actually, every single roll of Jenkins Gold Seal Tape has exceptional grip and staying power simply because it's got more tensile strength in the fabric, more live rubber in the friction compound.

That's not boasting...that's testing... every lot of the base cloth, every batch of the friction compound. The Jenkins laboratory asks more of every roll of Gold Seal than you'd ever think of demanding.

Every step of the whole process gets that kind of scientific control. Cloth and compound are made one so that there's never any raveling or peeling. And it doesn't dry out.

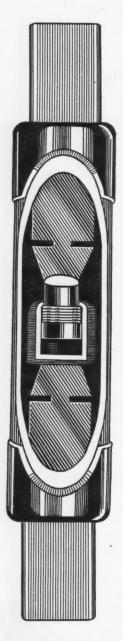
Then each perfectly made roll is wrapped in cellophane so that when you point to the big red Gold Seal box on your dealer's shelf, you always get the best friction tape at its factory fresh best. Jenkins Bros., Rubber Division, 80 White Street, New York 13, New York.

JENKINS GOLDEN TOPES

FRICTION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

Irion—the intelligent fuse—



It discriminates it gives triple protection!

- 1 Instantaneous cutoff on short circuit, like any other fuse.
- 2 Time-delay, averaging five times longer than that of any renewable or one-time fuse. A Trion permits the safe starting of heavily loaded motors; yet it also protects against single phasing.
- 3 Heat protection. Trion's Therm-A-Trip reduces and controls heating of switches and fuse clips, because it puts a ceiling on attained temperature—a ceiling nearly 500° I cooler than that of any kind of zinc-link fuse, either one-time or renewable.

The Chase Shawmut Company

New York Syracuse Philadelphia Baltimore

The 3-in-1 fuse with Therm A-Trip

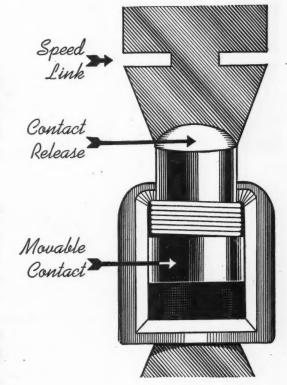
How it works—

When a short circuit occurs, one or more of the necks of the Speed Link are blown, instantaneously opening the circuit, and preventing damage to wiring or equipment.

Trion's Therm-A-Trip also opens the circuit when safe operating temperatures, whether surrounding or load, are exceeded. It matches its thermal capacity to the motor or transformer it protects.

When a safe overload is exceeded, the Therm-A-Trip, with its Contact Release and Movable Contact, absorbs heat, giving an extra long time-delay. Then the Contact

Release melts, and the Movable Contact, driven by its heavy spring, opens the circuit with the efficiency of a circuit breaker.





Fuse economy with circuit breaker efficiency



Newburyport, Massachusetts

Chicago

Dallas

St Louis

Omaha

Kansas City

Denver

Los Angeles

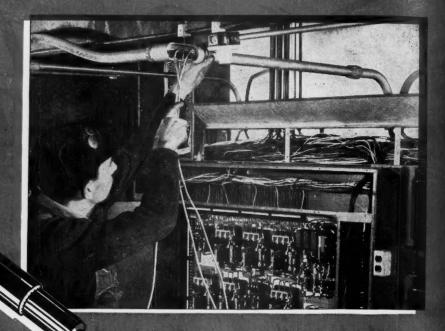
San Francisc

Seattle

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PARANITE

TYPE R
BUILDING WIRE



CONDUCTORS

Tinned copper (solid for the more usual applications, and stranded when greater flexibility is needed) in sizes A.W.G. No. 14 to 2,000,000 C.M.



INSULATION

"Better than code requires." Insulations from special compounds for higher dielectric strength for extra safety, are also available.



BRAIDING

Jacketed with cotton braid (single or double), saturated with moisture resisting, flame-retarding compound, and smoothly finished.



SMOOTH PULLING EASY STRIPPING TIME SAVING

THREE THINGS YOU CAN DEPEND ON in Paranite Type R Wire leading to panel boards, lighting circuits or factory machinery—

One: THE "FISHABLE" SLICK FINISH

Pulls smoothly through conduits—slides easily around bends and elbows—no joint jams. This non-migrating finish will not soften, gum or tack in hot weather or become brittle and crack in cold.

Two: FAST CLEAN STRIPPING

Outer braid strips with minimum effort. Inner rubber slips off cleanly exposing clean tinned copper conductor. No sticky, time-consuming layer of adhering compound to scrape. No dangerous reduction of conductor capacity by scraping of copper or accidental severing of strands.

Three: LOWER INSTALLATION COST

Just as 1 plus 2 equal 3, Point ONE (Paranite Fishability), plus Point TWO (Paranite Clean Stripping), equals Point THREE (Paranite Lower Installation Cost). THAT'S PROFIT!

PARANITE WIRE AND CABLE

Division of ESSEX WIRE CORPORATION

General Sales Offices: Fort Wayne 6, Indiana.

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IF IT'S PARANITE IT'S RIGHT!

SALUTE TO QUALITY

Pedignee Pedignee Vannishes

Engineers and shopmen in all parts of the country agree that Pedigree Varnishes do the job better.

Their time-honored position of leadership is your assurance of satisfactory performance under any conditions.

The Pedigree Varnish Catalog
is now available. Write at
once for your FREE copy.



INSULATION MANUFACTURERS CORPORATION

INSULATION AND WIRES
INCORPORATED

TRI-STATE SUPPLY CORPORATION

Manufactured by

THE P. D. GEORGE COMPANY, ST. LOUIS, U. S. A.

Your pipe threading takes less time and effort with THIS direct-action No. 1R

RIDID

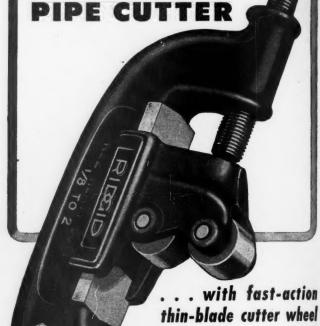
Threads 1" to 2" pipe Full-floating posts

Bushingless, quicksetting workholder

• If you prefer a poster threader, here's an improved one that's ready to thread 1", 11/4", 11/2" or 2" pipe most quickly and with least bother. Quick-set foolproof workholder has no bushings to bother with. No cockwobble in threading—handle pulls head and dies directly, floating posts merely taper thread, do no driving. Alloy or high-

speed steel chaser dies cut clean perfect threads, steel and malleable construction assures long service—and it sells at a popular price!.. Buy No. 1R at your Supply House.

Cut your pipe cleanly with more ease and speed with this new efficiency-balanced



• Slap this new RIPPID Cutter on a pipe, turn it tight and roll it right through your pipe in a few easy turns—thin wheel leaves practically no burr. You like the well-balanced feel of its new style malleable frame and the thin blade tool-steel wheel always cuts true—every cutter individually tested to assure it. Your choice of 5 sizes to 6" capacity and 4-wheel cutters to 4." For easier pipe cutting order RIPPIDS, at your Supply House.

4-wheel No. 42 for fast quarter-turn cutting.

Millions of RIPOID
Tools in use

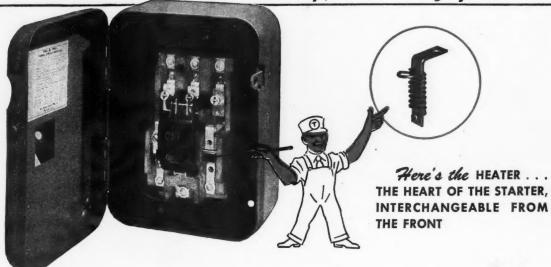
WORK-SAVER PIPE TOOLS

The Ridge Tool Company Elyria, Ohio, U. S. A.

E

TRUMBULL MANUAL STARTERS

Guardians of Your Motors



Protect what you have ... old or new

ion eel

3

To guard against damage to the motor, two types of protection are required . . . (1) Short Circuit, usually provided for in the form of the branch circuit fuse or circuit breaker . . . and (2) Overcurrent protection which will disconnect the motor from the line in event of overload or other conditions which causes the motor to consume more current than its design permits.

Trumbull TT (1 H.P.Max.), TM-2 (2 H.P.Max.) and TM-71/2 (71/2 H.P.Max.) are old timers with young

ideas and have served a long, long time under these conditions. (Of course if you require remote control of motors and undervoltage protection you'll need Trumbull MAGNETIC starters.)

But . . . and this is important . . . the construction of manual starters . . . and the interchangeable overload relay heaters with their easy accessibility, makes the difference between fully protected long life and excellent motor service . . . and merely "start" and "stop". Trumbull Manuals have an honored service record . . . as they'll prove to you on the job.

(Above) TRUMBULL TM Manual starter 2 and 3 pole, 440-600 V. Max., $7\frac{1}{2}$ H.P. Maximum.



(Left) TRUMBULL TT Manual starter 1 and 2 pole, 230 V. Maximum, 1 H.P. Maximum.

THE TRUMBULL ELECTRIC MANUFACTURING CO.

PLAINVILLE, CONNECTICUT

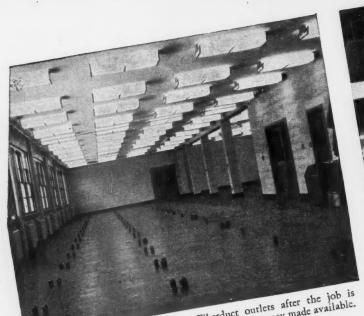
OTHER FACTORIES AT

NORWOOD, OHIO — LOS ANGELES — SAN FRANCISCO — SEATTLE

Electrical Contracting, March 1946

INSTALL G-E FIBERDUCT RACEWAYS

FOR ELECTRICAL FLEXIBILITY.

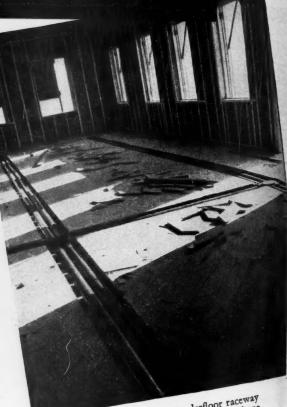


This photograph shows factory-set Fiberduct outlets after the job is finished and the floor laid. Notice the electrical adequacy made available.

Your customers will be delighted with the electrical adequacy and flexibility you can provide them by installing G-E Fiberduct underfloor raceways. They are ideal for factories, airport administration buildings, banks, etc.—wherever there are tration buildings, banks, etc.—wherever the duct at concrete or wood floors.

concrete or wood moors.

Electrical outlets can be preset in the duct at the factory or added later at any time. With G-E Fiberduct, factory machines, office appliances, signal devices and telephones can be changed be available will with assurance that power will be available for them in new locations. G-E Fiberduct is made of non-corrodible fiber and can be cut and installed easily.



Here a double-grid Fiberduct underfloor raceway system will make high tension and telephone services readily available.

FOR FURTHER INFORMATION on G-E Fiberduct underfloor raceways or on chan-Q-Floor Wiring see the nearest G-E Merchandise Distributor or write to Section General Appliance and Merchandise Dept., General Electric Company, Bridgeport, Connecticut

INSTALL G-E Q-FLOOR WIRING with Robertson Q-Floors

G-E Q-Floor Wiring makes an entire Robertson cellular steel floor become part of the electrical system. Outlets can be installed anywhere every six inches.

GENERAL & ELECTRIC

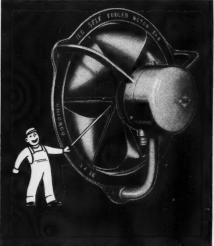
Ele

ILG DIRECT DRIVE REDUCES YOUR LABOR COSTS!



Direct-Drive
Centrifugal Fans

Direct-Drive
Self-Cooled Motor Propeller Fans



Sharply advancing labor costs can be offset to a great extent by specifying direct-connected ventilating and heating apparatus! There is no time-wasting alignment necessary... no belts or pulleys to increase labor on the job... no special motor bases to require extra work... no belt or chain guards to buy and install... no extras to knock down profits!

And, in addition, you give each job the best possible equipment—you save space, you have permanent alignment (no rapidly wearing parts),

you avoid shutdowns for replacements or servicing of parts, you eliminate power-wasting friction and noise, and your equipment delivers its full rated capacity!

Get latest data on ILG complete lines of heating and ventilating equipment from nearby Branch Office (consult classified directory) or write us today.



GET FREE COPYL

"An Engineer Looks, at ILG" is title of new 36-page picture book... specially prepared to interest men who design, specify, or install equipment. Get yours now.



VITALIZED VENTILATION

AND AIR CONDITIONING

ILG ELECTRIC VENTILATING CO.
2879 North Crawford Avenue, Chicago 41, 18.
Offices in 40 Principal Cities



Wire insulated with Geon is everywhere in

STARTING with buried service entrance cable, jacketed and insulated with GEON, all the wire used in this modern house is insulated with this modern material.

That's because wire insulated with GEON offers so many advantages—excellent electrical properties, to name one of the most important. Insulation made from GEON is flame resistant; increases safety, reduces fire hazard. Because of its outstanding electrical properties insulation

made from GEON may be used in thin coatings which means more conductors per conduit. It's smooth, too easy to handle and install; quickly identified because the entire NEMA color range is available. And, of course, it's Underwriters' approved.

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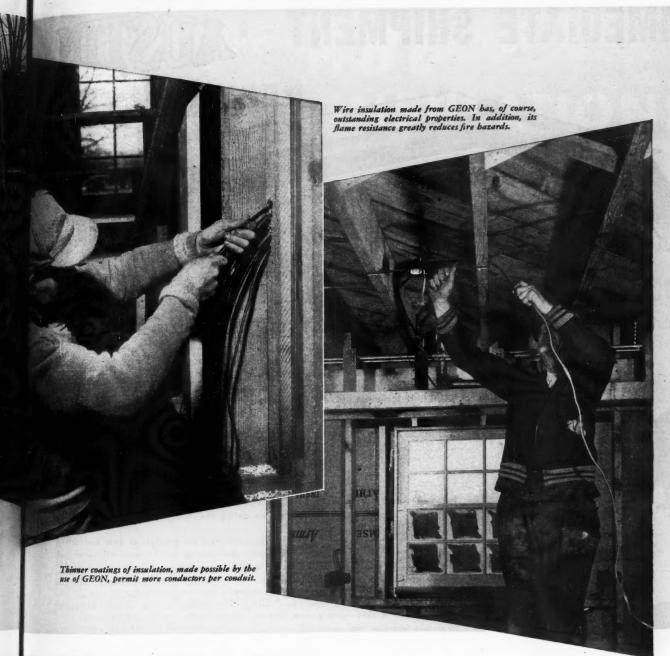
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applic

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As soon as the house is completed, more wire insulated with GEON will make its appearance. It may be in the form of appliance, lamp, and telephone wire. Or it may



ere in this modern house

s which be the hookup wire now being used in modern radio sets and other electrical devices.

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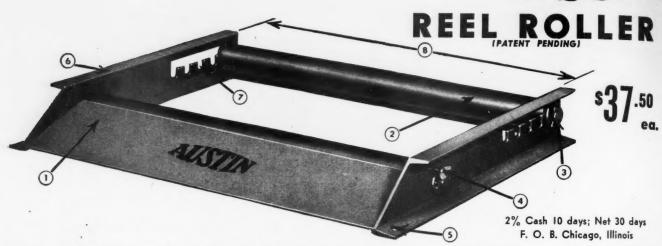
it may

All of GEON's advantages are available to users in domestic, industrial or utilities wiring. The next time you order wire or cable from your supplier be sure to specify insulation made from GEON. Or for help with specific applications please write Dept. Y-3, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.



B. F. Goodrich Chemical Company THE B. F. GOODRICH COMPANY

IMMEDIATE SHIPMENT .



FOR DISPENSING ANY MATERIAL THAT WOUND ON A REEL



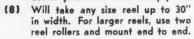
The new quick, easy and safe way. Reel is loaded in a jiffy with little or no effort. Requires a minimum and of valuable floor space.

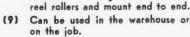
EVERY Electrical Contractor, Utility, REA Co-operative, Shipyard, Railroad and Wholesaler, should have several of these indispensable AUSTIN REEL ROLLERS. When pulling one or more cables into conduit, use an AUSTIN REEL ROLLER for each cable. Can be mounted stationary; or used on the job as a portable device—ideal for service and repair trucks.

Here's the best, the most economical investment you ever made—AUSTIN NO. 600 REEL ROLLER at \$37.50 each. Prompt shipment.

9 OUTSTANDING ADVANTAGES

- (1) Ramp-Makes it quick and easy to load the reel onto the rollers.
- (2) Back roller is mounted silghtly higher, preventing the reel from being pulled off the roller when cable is removed.
- (3) Reel rolls on grease packed flanged ball bearings with the greatest of ease and safety.
- (4) Thumb screw, which when tightened, prevents roller from turning for easy removal of reel.
- (5) Hole for lag screw, one in each corner for stationary mounting.
- (6) Heavy steel frame, painted bright orange, not only adds to its appearance, but, also makes it readily visible on the floor which helps to eliminate accidents.
- (7) Five adjustable slots to accommodate various reel diameters. No screws, washers or cotter pins to remove—simply raise up the roller and slide into the slot required.







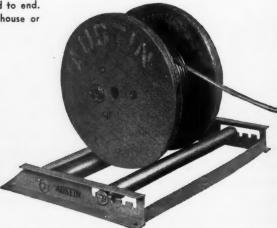
The old way-laborious, unsafe and costly.







THE AUSTIN REEL ROLLER makes this an easy one man job.



Note the roller adjustment for this small diameter reel. MAXIMUM CAPACITY 4000 LBS. WEIGHT 75 LBS.

THE M. B. AUSTIN CO.

108-116 S. DESPLAINES STREET 6. ILLINOIS CHICAGO

THE ABC OF HAZARD INSULATIONS

BUILDING WIRE

Type R - up to 5000 volts - 50 C. Excellent "code" grade building wire

HAZACODE

GENERAL USE

5000 volts - 60 C. High current carrying capacity - all coverings

PERFORMANCE

WET LOCATIONS

Type RW - 5000 volts - 50 C. Light weight-no lead-indoors or outdoors

WATERTITE

HIGH GRADE WIRING All-Purpose

Type RH - 8000 volts - 75 C. heat resisting, super-aging - all coverings

PERFORMITE

THERMOPLASTIC Building Wire

Types T and TW-600 volts-60 C.sizes No. 14 - 4/0 Dry and wet locations - no braid - small diameter

HAZAKROME

UNDERGROUND

5000 volts - Non-leaded - for submarine use or direct burial

SUBMARINE

POWER TRANSMISSION and General Use

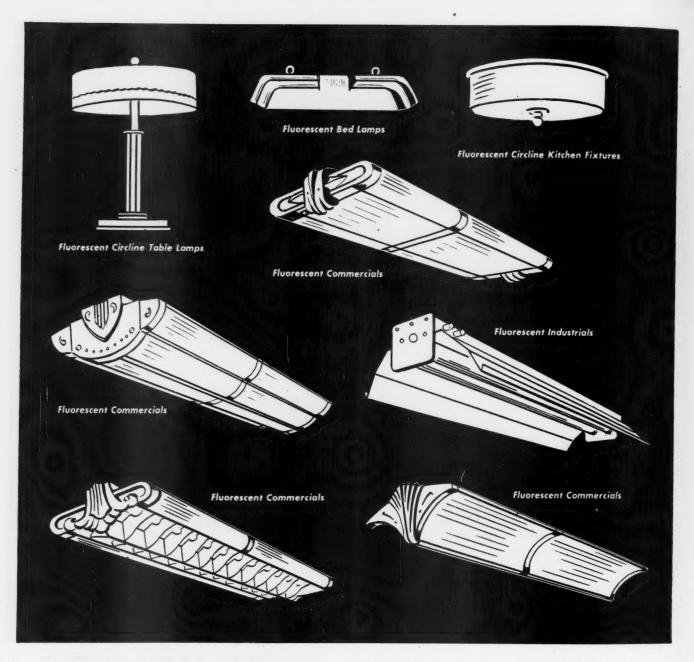
15,000 volts – oil base compound – 70-75 C. High voltage circuits, etc.

KEYSTONE



insulated wires and cables for every electrical use

4418



THE BEST THAT'S NEW IN LIGHTING

Lighting Products Commercial, Industrial and Home Fluorescents set a new high in styling, performance and sturdy construction. Engineered for better vision and constructed with

precision, these new L. P. I. units will more than take care of the entire range of your customers' demands. Look to Lighting Products for the best that's new in lighting.





IDEAL "WIRE-NUTS"

Make wire joints the modern way — no solder or tape, no heat; simply strip wires, screw on, that's all! Safer wire joint! Better electrically—Stronger mechanically. Accepted as standard in wiring—new circuits, re-wiring, plant changes, re-locating machinery, etc. IDEAL'S new low prices further cut wiring costs.



1640

A size for every job

— Four sizes make all common combinations from Two No. 18 to Three No. 10 solid or stranded wires. MILLIONS IN USE. Approved by Underwriters' Laboratories, Inc.

Free Samples on Request

PROMPT DELIVERY

RESISTANCE TESTER

Has wide variety of uses in testing and measuring insulation resistance!

Detects the weak spots in your electrical insulation before they can cause trouble — costly delays — expensive repairs. The NEW IDEAL Insulation Resistance Tester is always "on guard", one-step-ahead in preventing breakdowns, when you regularly check the insulation resistance, in all types of electrical circuits and equipment.

Entirely self contained—no batteries or external power supply to bother with — no brushes or commutators to require attention. Power is provided by small internal hand generator operated by slowly turning a crank. Always ready for instant use. Connect leads to the apparatus to be tested, turn crank and the correct test voltage is indicated by two small button lights. Range 0 to 100 megohms.

Write for FREE Bulletin

Motor Equipment Division

IDEAL Industries, Inc.

(formerly IDEAL Commutator Dresser Co.)

7041 Park Avenu

Sycamore, Illinois

Sales Offices in Principal Cities... Consult your local Phone Book In Canada: Irving Smith, Ltd., Montreal, Canada



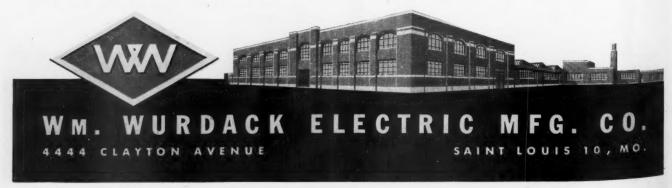
WURDACK SWITCHBOARDS ARE DESIGNED AND ENGINEERED TO FIT EVERY MODERN POWER PLANT AND BUILDING

All types and sizes of Wurdack Switchboards are available in especially designed, custom-built or standard units for utilities, industrial plants, public and private buildings.

The latest in safety features are applied to the construction and operation of Wurdack Switchboards. Shown here is the ER Safety Type Wurdack Distribution Switchboard. Switch units are Auto-Shift Type either single or double throw in capacities and voltages as required with on and off visual indication.

Dead front design prevents contact with live parts. Opening of switch doors automatically breaks circuit and shifts contacts—permits easy access to dead fuses which are rigidly held in place on an insulated base within the switch enclosure, protecting the fusible unit from shocks and jars.

Reserve your copy of the new Wurdack Fusible Panelboard Catalog, now!



FS and FD Series

give you an extremely wide choice of interchangeable plain and vaportight covers for junction boxes, switches, manual motor starters, pilot lights, plug receptacles.





FD Series. Deep body, take wiring devices up to 2 1/2° deep. 12 Types.















Type FS with bosses for tapping Available in One to Three-Gang. Take individual covers.



Types FS and FD for any arrangement of welded hubs. Available in One to Five Gang nd Two-Gang Tandem.. Take individual covers



Type FST Threadless with Tumbler Switch. FS and FD Series Condulets are available with threadless hubs for thick or thin wall conduit.



Type ExF Extensions Available for One to Four-Gung

The illustrations show a representative selection from the 1204 items listed in the FS and FD Section, Condulet Catalog 2500. (CONDULETS are made only by CROUSE · HINDS)



of a series of advertisements which demonstrate that CROUSE-HINDS "complete line" means much more than just a range of sizes—there is a wide variety of highly specialized types in each classification.























Nationwide

Distribution Through Electrical Wholesalers



CROUSE-HINDS COMPANY

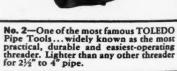
Syracuse I, N. Y., U.S.A. Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Kansas City — Los Angeles — Milwaukee — Minneapolis New York — Philadelphia — Pittsburgh — San Francisco — Seattle — St. Louis — Washington. Resident Product Engineers: Albany — Atlanta — Charlotte CROUSE-HINDS COMPANY OF CANADA, LTD., Main Office and Plant: TORONTO, ONT.

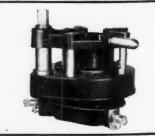
CONDULETS • TRAFFIC SIGNALS • AIRPORT LIGHTING • FLOODLIGHTS



Now's the time for pipe fitters to get set with the right tools—TOLEDO THREADERS—for best work in the great era of new construction ahead!

These Toledo-engineered tools will help you do a better, faster job of pipe threading—and reduce costs! Preferred by the man on the job for practical features that mean easy-threading, accurate, dependable operation. Backed by nearly half a century's leadership in building better pipe tools. Always specify TOLEDO! The Toledo Pipe Threading Machine Company, Toledo, Ohio. New York Office, No. 2 Rector Street Building.





No. 2 BR—Geared adjustable threader. Capacity 2½" to 4" pipe. Equipped with a new type 3-jaw pipe holder. Easy to center. Rapid, reliable performance.

RELY ON THE LEADER

TO PRECISION PIPE TOOLS



For more than 25 years dealers, electrical contractors and public utilities have recognized the green Virden "V", wearing its banner "Virden Values" as a pleasant and gratifying sight when they unwrapped each package. Pleasant because it meant good equipment, gratifying because good fixtures simply and intelligently assembled give assurance to every worker that he is participating in the installation of a good job. It stands for the same practical benefits in 1946. We are proud to identify these smart, well built fixtures as inherent "Virden Values". Available at your jobbers.

John C. Virden Company · Cleveland, Ohio

THE PRESIDENT'S WAGE-PRICE POLICY WON'T WORK

HE AMERICAN public had every right to expect that the long-awaited wage and price policy would break the impasse blocking the way to the swift and orderly reconversion of industry from war to peace.

The policy announced offers little promise of such solution, and this may well constitute a national calamity.

There is only one thoroughly constructive feature of the Presidential Statement of February 14 and its implementing Executive Order. It is the first Government pronouncement since the defeat of Japan to clearly define inflation as the major danger confronting us in the period immediately ahead.

That is a correct appraisal, and one long overdue. Up to now Government spokesmen, almost invariably, have sought to carry water on both shoulders. The Administration has justified its policy of promoting wage increases as a measure necessary to forestall deflation—to keep purchasing power from falling and forcing the economy into a violent tailspin. The strict holding-of-the-line on price ceilings has been defended as necessary to prevent runaway inflation. Unfortunately, while the President now exhorts all to enlist in a crusade against inflation with a voice that is clearly Jacob's, his program for dealing with it still employs the hairy hands of Esau to promote the very danger which he is urging everyone else to combat.

The "new" policy provides for a continuation of the wage increases that have been pressured through by Government mediators, "fact-finding" boards, and direct seizures until they have been made general throughout industry upon the dimension established in recent patterns. It offers industry the single concession of prompt hearings and decisions upon claims for price advances, but the yardsticks for judging such claims are exactly those which OPA has applied in the past. Since the past procedure has led us into our present difficulties, it is hard to see how it will serve now to lead us out of them.

Past Government Policy Fostered Dissension

At the war's end, it was obvious to everyone that what was needed was the swiftest possible reconversion of industry. It should have been equally apparent that we were faced with the difficult problem of controlling tremendous inflationary pressures which would be particularly insistent until peacetime production could be mobilized at high volume. This was made almost inevitable by the huge backlog of accumulated demand, for both capital and consumer goods, and by the unprecedented volume of liquid funds at the disposal of individuals of all classes. The only circumstance that could have modified the inflationary complexion of the postwar picture was the possibility of such wholesale and prolonged dislocation and unemployment in the process of readjustment that people would have been frightened into freezing onto their savings instead of spending them.

It soon was apparent that just the opposite was taking

place. The early transition was extraordinarily swift, unemployment was lower than anyone had dared hope, and civilian spending outstripped all previous records. The circumstances called for strong anti-inflationary fiscal measures, along with a firm maintenance of price and wage controls alike.

Instead of adopting such a balanced program, the Government immediately discarded all wage controls, and in addition started an active campaign for promoting large wage increases. The President, upon a number of occasions stated flatly that American industry generally could and should grant substantial pay advances without any compensating price rises. His Office of War Mobilization and Reconversion estimated that average increases were practicable to the extent of 24 per cent. Given such Governmental encouragement, it was inevitable that labor leaders should do exactly what they did-file extravagant wage demands at the beginning of the reconversion process, when accurate appraisal of production schedules and costs were least susceptible of calculation, and when the shortage of civilian goods multiplied the inflationary effect of any increase in purchasing power.

At the same time, the OPA was fighting to hold the price line in a good cause, but with singularly inept procedure. It acted, seemingly, upon the premise that it was always better to give less price relief than was needed rather than enough, that relief provided under its formula was preferably to be granted later rather than on time, and that the interests of lower-bracket income receivers should be protected by a particularly tough resistance to raising prices of cheaper goods. The latter procedure seems to have boomeranged by virtually driving many of the lower-priced lines off the market.

The sum of these wage-price procedures resulted in work-stoppages of epidemic scope. Many business concerns faced with the prospect of immediately unprofitable operation, uncertain that new wage demands would not be made with Government support as soon as volume production was established, and without assurance as to when price controls would end, refused to assume inevitable losses even when confronted with combined union and Government pressure. The fight was on.

"New" Policy Differs Little From Old

With inflation now clearly recognized as the immediate danger, it might have been expected that the new wage policy would reverse the former practise of lending active encouragement to new wage advances. But that would have brought down upon the Administration the wrath of all organized workers who had not yet been granted increases already bargained through by other groups. This was avoided by directing the National Wage Stabilization Board in effect to approve any wage increases necessary to give general advances comparable to those already made. The only brake applied on the wage side lies in a directive to the Board not to approve, as a basis

for price relief, wage advances that go beyond the established pattern.

On the price side, the new directives to the OPA entail no important departure from its past procedures. Even the concession to review "hardship" cases promptly rather than after six months is only a pious hope, since it is unlikely that OPA is equipped to deal rapidly with the thousands of cases that will arise. A hardship case is defined as one in which, after absorbing an approved wage advance, an industry or establishment in a twelve months' period of normal-rate operation is judged by the Price Administrator likely to operate at a rate of profits to net worth less than it averaged in the base period of 1936-1939.

Let us see what this really means. In the first place, the rate of manufacturing profits in the base period was only moderate. But since the average net worth of manufacturing corporations has increased one-third over what it was in the base period, the application of the OPA formula, assuming that its Administrator correctly appraises the twelve-month outlook, seems to provide for absolute profits one-third higher than the 1936-1939 aver-

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The OPA formula, however, applies to profits before taxes. What really matters to stockholders is profits after taxes. Corporation taxes have been increased from an average of 17 per cent in the base period to 38 per cent now. This means that the price adjustments granted by OPA on average will yield profits after taxes no larger in dollar terms than in the 1936-1939 period, although 1946 manufacturing sales are expected to be more than twice as high. Under this procedure the ratio to net worth of profits after taxes will be one-fourth lower than the 1936-39 average. This clearly undermines the incentives upon which production at high level depends.

The workers get wage increases which promote inflation. The Government, bailed out from its previous mistakes, gets political credit for raising wages. And the entire bill is handed to American industry for payment.

But the Danger of Inflation is Real

Under these circumstances, there is a growing demand on the part of business groups that price controls be rescinded immediately. It is argued that, once the restrictive influence of price controls is relaxed, capacity production soon will supply sufficient goods to prevent undue price inflation.

It is understandable that business should wish to be rid of Government controls which have operated in such a thoroughly inconsistent and damaging fashion. Unfortunately, there is ground for believing that more harm might result from this cure than from the disease.

There is nothing in our situation that could bring on the kind of inflation that has been experienced by certain countries of Europe and Asia—in which the value of currency deteriorates until it takes a cartload to buy a pair of shoes. But our situation now is definitely more threatening than it was in 1919, after the first World War. At that time wholesale prices and the cost-of-living skyrocketed almost 25 per cent within twelve months. If we discard all controls now, as we did then, prices might easily go up from 25 to 50 per cent in a year's time.

An inflation of that dimension can do tremendous damage. While it lasts, all those dependent upon fixed incomes are damaged—all bondholders, including those who hold

war bonds, all life insurance and annuity beneficiaries, all pensioners. Generally, the purchasing power of wages and salaries would shrink, with white collar and unorganized production workers hardest hit. Controlled-rate industries, such as railways and other utilities, would be squeezed. General business would suffer least of all—while the boom lasted.

But such soaring booms cannot last. The 1919 boom burst in mid-1920. By summer of 1921 industrial prices had fallen 40 per cent and industrial production was off 35 per cent; farm prices had fallen 50 per cent. This time the boom might soar higher and last longer, but that would merely result in an even more precipitous drop. Business would be hard hit along with everyone else, and high wage rates would mean nothing to the unemployed.

Controls Must be Consistent and Progressively Relaxed

But if the Nation cannot afford to risk disastrous inflation by immediately abolishing controls, neither can business afford to accept the program which the Administration now proposes.

The wage-price policy will not hold the inflation line so long as the Administration is leading the assault to breach that line on the wage side, as it has done ever since VJ-Day.

The Administration is now going before Congress to ask for a broad extension of its wartime powers for an additional year beyond June, 1946.

Congress must see that this is not granted except upon terms that guarantee the use of such power with a consistency that has been conspicuously absent up to now.

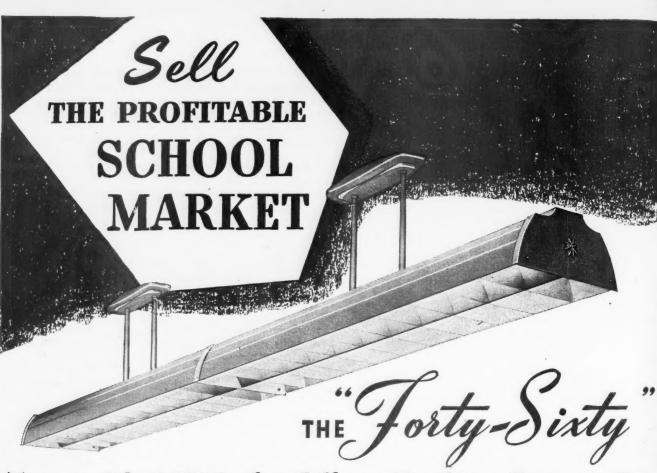
- 1. It must provide sufficient price relief to yield profits normal to high-level operation.
- 2. The basis for price relief must be clearly defined and geared to actual costs of operation at the earliest possible date
- OPA administrative procedures must be speeded-up and streamlined, or the delays that characterized past administration will become intolerable.
- 4. It must see that, once established, the new line is held as long as wartime controls are continued by enforcing restrictions on wages as well as prices.
- 5. It must set an early date for the termination of all wartime controls and provide for progressive and bold steps for de-control to be taken before that date, as soon as production levels in any field are sufficiently high to restrain runaway prices.

6. It must proceed without delay to marshal fiscal and monetary policies to combat inflation, in order that price controls may be discarded at the earliest possible date.

Unless Congress does this — and it will not be easy in an election year—we are headed for an explosion. It will come in one of two forms—either in a continuance of industrial strife, or in a rocketing inflationary boon that can only end in collapse and depression.

Mus H. W. haw. N.

President, McGraw-Hill Publishing Co., Inc.



Also an Ideal Unit for Offices, Drafting Rooms, Etc.

There are lots of jobs which require a unit built primarily for eye comfort and the "Forty-Sixty" is the unit to help you get your share of this business.

Go after this business...sell school room, drafting room and office installations. The "Forty-Sixty" has all the selling features necessary to build up volume sales. Here are a few high lights on the features of the "Forty-Sixty" (Catalog No. 4060). This unit has a low fixture brightness...it directs approximately 40% of its light upward and 60% downward...it's made of Alzak Aluminum...all metal with resultant low maintenance cost. The "Forty-Sixty" is ideal for use in individual or continuous line installation.

Complete technical data and details are yours for the asking... Ask today and sell this profitable business tomorrow!





MARCH at a Glance

Honors

Distinguished honors came to several electrical contractors on February 26 when the 7th Biennial Award for Chemical Enginering Achievement was given to the prime contractors who created the great atomic energy projects under the Manhattan Engineer District of the War Department. They included Bryant Electric Co., High Point, N. C., L. K. Comstock & Co., New York, N. Y., A. S. Schulman Electrical Co., Chicago, Ill., and Watson-Flagg Engineering Co., New York, N. Y.

Service

Steve O'Brien is probably one of the best known men in the electrical business. He is a tireless worker in industry affairs, such as heading up the vast Electric & Gas Association of New York. The rest of the time he is president of the S. J. O'Brien Sales Corporation of New York where thousands of electrical service jobs, large and small, flow through the smooth routine of a top-notch organization. Their new headquarters, designed and laid out for high speed electrical service through carefully planned shop and management methods, is the subject of "Service" by B. C. Cooper, on page 60.

Show

Many new designs of lighting fixtures are promised for the International Lighting Exposition at Chicago's Palmer House April 25th to 30th. Program arrangements include meetings for electrical contractors on Saturday morning April 26. For details see 171. For tickets please send us the coupon on page 129. We'll have a booth at the show—hope to see you there.

Engineering

New engineering developments, some from under the wraps of war censorship, others from the laboratories and factories, filled a solid week of discussion at the Technical Conference of the American Institute of Electrical Engineers. We have selected a few of the highlights and abstracts from those papers of particular interest to electrical construction, installation and maintenance. You'll find the review on page 58.

Wage Price

When the administration announced its new wage-price policy as the steel strike was settled, Electrical Contracting's Publisher Lee Hill made a telegraph survey of principal electrical manufacturers to measure the effects on prices of electrical products. The results, a pretty accurate measure of where prices are headed in the next few months, are given on page 169.

Interstate

You're in interstate commerce, according to the Supreme Court's decision in a case involving Roland Electric Company of Baltimore. It

held that motor repair essential to the production of a customer whose products entered interstate commerce was enough, and the federal Wage-Hour law applicable. This is one of the broadest expansions of the Wage-Hour law yet. You'll find the details on page 169.

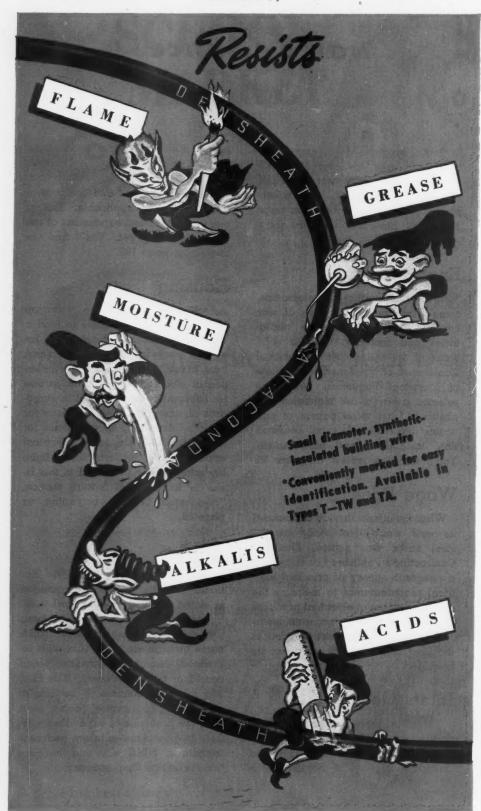
Housing

Residential construction has top priority now, will continue to hold a front rank position in construction for several years at least. At the same time, house wiring, so long the underdog of electrical construction, is due for substantial improvement in standards of adequacy. Wiring ideas for modern homes, up-to-date plans for accommodating the latest electrical appliances and modern built-in lighting schemes are presented in this issue in an editorial feature section, "Residential Wiring" beginning on page 65.

NISA

This year's convention of the National Industrial Service Association is slated for next month, April 8–10, in Tampa, Florida. A vigorous, young organization of motor shops, NISA came through the war years with increased membership and a proud record of accomplishment. The Florida meeting promises to be one of outstanding importance, facing, as it will, the problems of expanding markets in peacetime industry and new standards. NISA is setting the pace for the motor shop industry.

Jensheath Type T and TW BUILDING WIRE



Equal to the most severe exposures, it's the wire to serve you best for normal interior use.

- ★ Remarkably durable insulation-a synthetic compound of extremely dense formation. Smooth, polished finish.
- ★ Highly resistant to moisture, acids, alkalis, chemicals, mineral, animal and vegetable oils.
- ★ Will not ignite, burn or support combustion.
- ★ Unusually pliant—has no "spring." Retains any bend.
- * Tensile strength and elongation similar to values obtained on rubber compounds.
- * Super-aging compound superior to any rubber compound in resisting ozone, oxygen and sunlight.
- ★ Dielectric strength superior to that of usual grades of rubber insulation. Good insulation resistance. Low specific inductive capacity.
- ★ More circuits per conduit-for new installations, extensions and mainte-
- * Resists a reasonable degree of abrasion, tearing, bending and flexing.
- * Strips easily; leaves bright con-

Densheath is also ideal for use in wiring machine tools, equipment in acid treating plants, chemical plants, wherever single or multiple control cables are exposed to unusual hazards. Available in a variety of colors. Anaconda Wire & Cable Company, Subsidiary of Anaconda Copper Mining Company, General Offices: 25 Broadway, New York City 4, Chicago Office: 20 North Wacker Drive 6, Sales Offices in Principal Cities.

*Type T† for dry locations; Type TW† for moist locations. †New designations for Types SN and SNW



NACONDA WIRE & CABLE COMPANY

SPRINGBOARD FOR LIGHTING

The International Lighting Exposition, in Chicago next month comes at a critical moment in the history of lighting. It will provide the springboard for many new lighting fixtures and components. It will provide a national forum for the discussion of lighting methods and markets. It will bring together men from every branch of the industry seeking knowledge and understanding of this vitally important field.

Looking back about 15 years, lighting accounted for about one quarter of commercial and industrial electrical work. Today it is up around one-half, and likely to hold at least that ratio in the period of electrical development just ahead. So half the pipe and wire, the panelboards, boxes, schedule materials, locknuts, fuses and labor-hours will be pretty much influenced by what we do with lighting in the coming months. Every forward looking program and policy that brings constructive forces to bear on lighting development, technically or promotionally, deserves the full support of all the electrical industry. They are particularly important to the contractor.

In the next ten years we have to relight America. The number of factories, offices, stores, schools or homes that even approach accepted lighting standards are an almost insignificant fraction. It's a job of such magnitude and importance that it will require sound engineering and understanding of modern methods and lighting components on a broader scale than ever before. That means continuing industry educational programs.

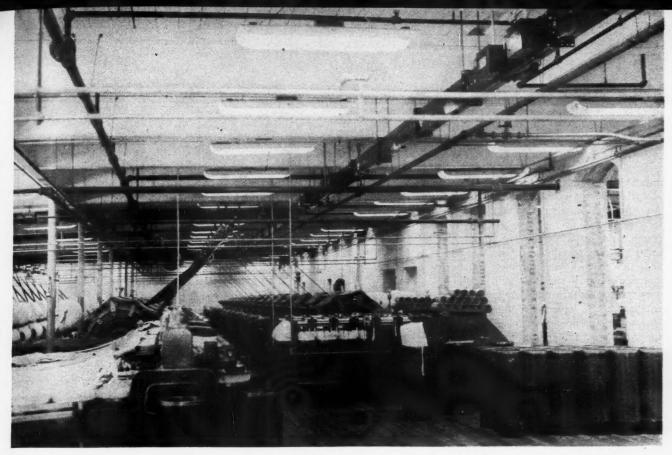
It also means a definite individual responsibility to keep informed and up-to-date.

Lighting progress, however, is not a continuous evolution of accumulating minor improvements. It moves with great leaps based upon radical inventions and designs. The difference between the latest laboratory development and the obsolete installation is usually so great as to defy comparison, and progress is so fast that conventional installations are often far behind already well established technical achievement. Educational forces to narrow the gap, to bring every-day practice up closer to the frontiers of lighting progress, are especially important right now.

The International Lighting Exposition deserves enthusiastic support. It is of major importance to everyone in the industry. It should have a large attendance, from among the contractors particularly. And we hope that those who are fortunate enough to attend, and to join in the discussions there, will bring back to their colleagues a clear picture of modern lighting development. We know they'll bring back, too, a new enthusiasm for the job ahead.

Wm. J. Stuart





View showing the 600 amp. bus-duct run. This also shows the only machines in the mill that are belt driven, all the rest being individually motorized with Tex-Rope drives.

OLD COTTON MILL GOES MODERN

Bus systems, methodical distribution layout and efficient lighting are important elements in modernizing this historic cotton mill.

HE old Nims Mill of Mt. Holly, North Carolina, had its origin in 1891 at the big bend of Dutchman's Creek about a mile north of town as a plant completely driven by water power. Now a subsidiary of American Yarn and Processing Company, it is known as American Yarns, Inc. One of the older mills of the South, electrical modernization is helping it keep pace with rapid developments in the textile industry.

Although a modern plant for the manufacture of industrial thread yarns, manufacturing operations are housed in a building partially erected a little more

By James T. Meador

Electrical Engineer, Southern Electric
Service Company, Charlotte, N. C.

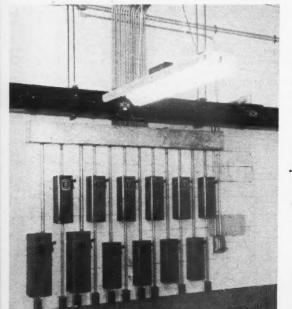
than half a century ago. Changes which have been effected in the physical property are indicative of what can be done in a modernization program directed toward meeting increased competition.

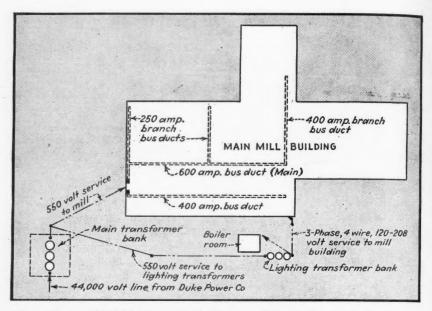
A one and one-half story brick building and a storehouse, and some dozen or more residences for operatives were erected. From time to time through the years the mill building and village were enlarged, and additional machinery for spinning carded yarns and for the production of seine twine and cable and hawser cords was installed.

In 1920 this mill, with others, was consolidated into one corporation, known as the American Yarn and Processing Company, but some ten years later this particular plant was closed, the machinery disposed of, and the mill building and warehouses used as storage warehouse space for the expanding business. In 1944, at the request of the government, new machinery was purchased, the buildings renovated and modernized. Before the machinery could be erected the end of the war came, but the reconversion of

the plant continued; it is now in operation. This installation consists of a new picker room equipped with modern machinery, set up to run on Egyptian cotton. The card room was refloored and new Saco-Lowell cards and combers installed. Whitin drawing and fly frames comprise the roving process equipment. An Abington vacuum stripping system for the cards was purchased and is ready to be installed. In the spinning room and the remainder of the second floor new Saco-Lowell spinning frames and new H & B twisters, with Foster winders and Whitin reels, comprise the equipment. A new boiler house with new boiler was erected to furnish steam for a modern heating plant.

The mill is lighted with fluorescent lights and all main wiring is carried in



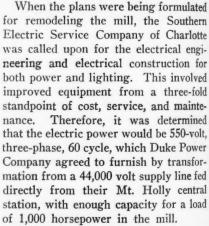


Line voltage of 44,000 is stepped down to 550 for bus duct distributor throughout plant. Lighting transformer converts power to 120-208 volts.

bus-ducts. The inside color scheme is in colors so arranged to eliminate all glare and accident hazards. All platforms are of reinforced concrete between mill and waste house and warehouse.

This plant is laid out to produce combed cotton yarns, 8s to 26s, any ply. There has been no effort spared to make this a model for a modern thread mill, as may be seen by the accompanying photographs, and after many baffling delays in obtaining material and equipment, it was fully modernized and in production by July of last year.

Group of magnetic contactors in Picker Room controls the various machines in this department which are remotely located and have related and interlocked operation.



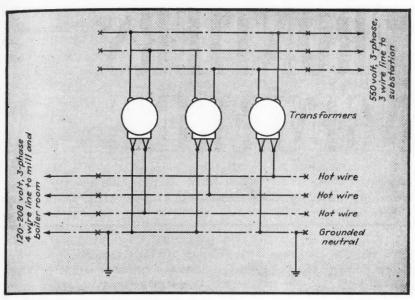
For the distribution of electric power in the mill these two different types of electrical systems were considered on the basis of both cost and future capacities: (1) conduit system with central switchboard; and (2) bus-duct system without switchboard.

The conduit system would have had a service feeder from the outside wall nearest the power transformers to the switchboard room, of two three-inch conduit lines of three cables (500,000 circular mils each), a distance of approximately 100 feet. The switchboard was contemplated as being of the "free standing" type where all the switches, fuses, etc. are totally enclosed on all sides with a steel case or box, leaving the switch handles only exposed. This

Partial view of the Spinning Room, showing the application of wide-range, variable pitch, Tex-Rope drives to the individual textile mill motors. Fed from bus on ceiling of floor below, motors are protected by combination manual disconnect and magnetic contactor motor controls.

Electrical Contracting, March 1946





Lighting utilizes 120 volts while auxiliary motors (stokers, fuel pumps, etc.) are powered by 208 volts. Neutral ground is common to all circuits.

was given first place in our consideration because of the long and very satisfactory record of trouble-free service in cotton mill operation where the accumulation of lint is prevalent. From here the branch circuits were considered to be of the 100 ampere rating, consisting of $1\frac{1}{2}$ -inch conduit with three No. 1 Type R Cables (varnished cambric cables were not available at the time), which, according to the National Electrical Code, permitted tap-off circuits to the various motors, etc., of one-inch conduit and three No. 8 Type R wires.

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The bus-duct system, with service entrance directly on the inside of the mill wall adjacent to the power transformers, eliminates the necessity of any switchboard at all. This was divided at the entrance so that one branch of 600 ampere capacity duct ran directly through the length of main section of the mill, then branched out through the wall to the picker room. The other branch of 400 ampere capacity ran through the length of the other section of the mill in a straight line. Both branches were mounted immediately under the beams of the ceiling of the first floor by means of coach rods and brackets, which permitted circuits to be run from the "plugin" adapter switches across the ceiling and down to any motor needing connections, also circuits could be extended from these adapter switches upward, through the floor to any machine on the second floor without overhead wiring.

By comparison, the bus-duct system showed a slightly lower installed cost, and an infinitely wider range of flexibility and future capacity than the conduit system. So, upon this basis, the bus-duct

system was approved, and the Square "D" product was chosen. The accompanying photographs show, in a general way, the manner in which the bus-duct is installed, with the branch circuits extending out from the "plug-ins," which can be seen as being mounted on the sides of the bus-duct at various locations.

Also of interest is the lighting system which was developed in this plant and which might well set a pattern for the lighting of textile mills in general due to the flexibility and advantages which we will set forth as we go along. The arrangement of the mill building in this case was such that the lighting system might be termed as a compact layout,

inasmuch as the lighting transformers could be located practically in the center of the lighting distribution system as will be seen.

This permitted the use of a group of lighting transformers located at about midway of the mill, on the back side and right adjacent to the boiler room, with the supply power coming directly from the main power transformer bank located a short distance away. They provide for lights throughout the mill at any and all times, regardless of the power being cut off from the mill.

The main transformer bank is completely surge (lightning) protected, with automatic reclosers to restore the service within the very shortest space of time should it be in any way interrupted. It is supplied by power at 44,000 volts, and transforms this down to 550 volts for use as power in the mill, as shown in accompanying illustration.

The lighting transformers change the 550-volt power to a three-phase, four-wire, network type of system giving 208 volts on power and 120 volts on lighting. There are three transformers in this group, arranged and connected, as shown in Fig. 2, which provide three-phase, 208-volt current for the boiler room auxiliaries, such as stokers and feed pumps, etc., and, also provides 120-volt current on each of three branches for a balanced lighting load.

Such an arrangement is notable in that one bank of only three transformers is necessary to provide both power for auxiliaries and current for lighting. This in turn simplifies the electrical system

[Continued on page 119]

Entrance switches for the bus-duct system on the main mill circuit (600 amp. run) and the side circuit (400 amp. run). The plug-in switches may be seen mounted on the side of the bus-duct.



Electrical Contracting, March 1946

NEW FRONTIERS ENGINEERING

Highlights in new trends of thought and accomplishments presented at the AIEE Convention.

VER 2500 electrical engineers converged on New York City for the five day annual winter convention of the American Institute of Electrical

Engineers, January 21-25.

The theme, "New Frontiers", was stressed by the featured speakers and was reflected in the basic thinking revealed through the technical papers. Under the stress of a world crisis, engineering and science increased their strides tremendously and the resulting achievements with atomic power, radar, communications, aviation and industrial applications were, in large measure, electrical.

Combined Light and Power Systems For Industrial Plant

The upward trend in illumination levels in industrial plants has resulted in an increased power demand of the lighting load. The lighting load is a sizable portion of the total plant load. In many average manufacturing plants the lighting load will represent 2 to 4 volt-amperes per square foot, and the power load 8 to 10 volt-amperes per square foot. The same technique that has been applied in distributing power to machine tools and other power loads will pay dividends in distributing power to the lighting load.

For incandescent lamps 120-volt systems have been used almost universally. Higher-voltage incandescent lamps are fragile and generally not satisfactory.

With the introduction of fluorescent lamps the 120-volt restriction no longer applies. All fluorescent lamps have ballasts in series with them. By combining a slight transformer action with the ballast, the fluorescent lamp ballast can be supplied at any voltage from 120 to 260 volts. The industry, however, has standardized on the following ballast

ratings; 118, 208, 230, and 260 volts. The introduction of higher-voltage fluorescent lamp ballasts has opened new avenues for using higher-voltage lighting circuits, thereby reducing the cost of the power system which supplies the lighting load. The trend toward load center power distribution systems also has enabled the use of combined light and power systems for industrial plants.

Combined light and power systems are expensive than systems using separate substations for light and power.

High-voltage lighting circuits are generally most economical when using 260-volt 2-lamp 100-watt fluorescent lamp ballasts, so that the lighting load may be operated directly off the 480-277-volt substation without intervening transformation. Generally 120 volts are most economical overall for 40-watt fluorescent lamp installations.

With the modern load center power system, the objectionable flicker from welders practically can be eliminated by using separate transformers for resistance welders or by serving the lights from one transformer and the resistance welders from another in a secondary selective system.

Three basic combinations of power supply for lighting systems are considered.

1. A 208Y-120-volt 3-phase 4-wire power system for lighting load, with separate substations for 460-volt power for motors, and the like.

2. Combined substations for power and light, that is, one 480-volt substation serving motors directly and the lighting load through step-down dry-type transformers located at strategic points through the factory.

3. A 460Y-265-volt combined power and lighting system in which the motors are operated at 3 phase, 460 volts and fluorescent lights from phase to neutral at 265 volts, from the same substation.

It is assumed that the primary feeder system is the same, regardless of which of the three afore-mentioned systems are selected. Therefore, the items considered are the step-down substations, secondary feeder circuit breakers, secondary feeders, dry-type transformers, panel boards, and branch wiring.

Marine Radar for Peacetime Use

Military radar systems by the score have been developed for such varied purposes as surface search, aircraft detection, height finding, gunfire control, range finding.

In most of these systems, the prime function was in some way connected with locating the enemy accurately, judging his course, speed, and strength, and getting this knowledge quickly enough to take appropriate counter-Design considerations that action. affected cost, complexity or operator skill, were less important than those which governed range, accuracy or resistance to gunfire shock.

The importance of these factors was reflected into the space and power requirements of the military equipment, and the design elements that permitted excellent military radar are often those which make for an unsuitable peacetime radar.

The intrinsic value of ships, cargo and time lost because of poor visibility mounts to enormous proportions. This waste can be reduced to a very small amount by the use of radar equipment properly designed for the job.

The design variables which are controllable include at least the following: Reliability, simplicity, accuracy of range and bearing, cost, ease of maintenance, resolving power (on adjacent objects) maximum range, minimum range, appearance, accessibility and size.

Early in 1943, experiments were conducted on a Great Lakes ore boat. From these early experiences the present "Electronic Navigator" evolved.

An antenna system is driven by a gear-motor located in the antenna base, or "pedestal", and a slatted reflector rotates continuously at 10 rpm. The reflector is proportioned to project a beam 5° wide and 15° high.

A console contains the transmitter, receiver, cathode ray tube, sweep circuits, pulsing circuits, rotating field mechanism, appropriate power supplies and controls. During normal operation, seven controls are available to the operator. Having adjusted the instrument and selected the desired range scale (2, 6 or 30 miles) no further manipulation is required, unless it is desired to take a bearing on some specific object.

The pulse is considerably less than one microsecond in length and repeats at approximately 1000 cps. Thus the peak power delivered to the magnetron is of the order of kilowatts, though the average power is but a few watts.

The returning echo from the "target" is collected by the parabolic reflector, focussed on the antenna dipole, and carried through the T-R Tube to the receiver circuits, The returning signal is amplified and applied to the control grid of the cathode ray tube.

In the meantime, the antenna assembly has been rotating continuously, and its motion has been transmitted by a very compact and simple Selsyn system to the rotating magnetic deflection coil located around the neck of the cathode ray tube. Impressed across this rotating coil is the sawtooth sweep voltage which provides a linear, radial time axis. Time is synchronized with the transmitter, and as both the outgoing pulse and the returning echo travel at the speed of light, this time axis measures distance.

The overall result is that as the radial time (i.e., distance) axis rotates, any returning echo will intensify a portion of this axis as the rotating antenna "beams" on the target.

A long persistence screen is used, in which the cathode ray first excites a short persistence phosphor, which in turn causes a second, long persistence phosphor to glow. This glow persists for a long enough time to "remember" a scene until rekindled by the next rotation of the radial sweep.

Since the resultant illumination is in the form of a plan view of the surrounding area, with one's own ship at the center, the system is commonly termed "Plan Presentation Indicator" or simply "P.P.I."

2300 vs. Higher Voltage for Industrial Plant Generation and Distribuiton

Probably the most serious electrical bottleneck encountered in industrial electrical systems is associated with the use of 2300 volts as the main distribution voltage. Is 2300 volt operation really justified or would a higher operating voltage have been more economical? A number of studies which have been made recently based on present day equipment components seems to indicate that rarely will 2300 volt operation show the best economy.

The chief factor which leads to the selection of a 2300 volt distribution potential is the desire to operate directly from the distribution system as much of the motor load as possible (often including motors as small as 50 horse-power).

Motor equipment for 2300 volt operation incurs a substantial price penalty relative to 440 volt designs, particularly for the smaller hp. ratings. The price difference amounts to about 15, 5 and 3 \$/hp. for unit motor ratings of 50, 150, and 200 hp. respectively.

There remains the problem of serving motors of unit ratings exceeding 200 hp. In general the aggregate magnitude of this load will be a minor fraction of the total plant load and exercise little effect in the choice of system operating potential.

These larger motors can be served at 4000 volts with relatively small price difference which becomes less as the motor size increases. If the selection of 4160 volts shows good economy in other respects, it will be appropriate to serve the larger motors directly from this system.

It will be of interest to examine the basic advantages of higher operating voltages in the main distribution system. They are accounted for by improved economy in primary distribution circuits; lower primary switching equipment costs; improved economy and simplification of the main station bus arrangement.

The feeder circuit investment costs diminish as the operating voltage is increased. The most economical feeder rating also increases as the operating voltage increases.

Operation of feeder circuits at 4000 rather than 2300 volts indicates a saving of about \$1 per circuit kva. per 1000 ft. Elevation of operating potential to 13,200 volts offers additional savings of about \$\frac{1}{2}\$ per circuit kva. per

1000 ft. if individual circuit kva. ratings can be kept high (not less than 3000 kva.). The cost of circuit terminations may detract from the economy of 13,200 volt operation if the average length of runs become low.

For the same interrupting requirements, 4000 volt operation is in no instance, more expensive than 2300 volt operation and offers some savings in certain regions. 2300 volt operation entails substantial penalties at circuit normal ratings in excess of 4800 kva. (principally associated with source circuits). Operation at 13,200 volts involves more costly switching equipment (roughly ½ to 1 dollar more per circuit kva.) which may be offset by economic gains in other components.

The design arrangement of the main station source buses is the spot where the shoe pinches most with an operating potential of 2300 volts. Upon reaching a short-circuit interrupting level of about 130,000 kva., momentary current requirements will be in the order of 50,000 amperes. Equipment designed for greater momentary current ability involves substantial increase in price which generally cannot be economically justified.

With an operating potential of 4000 volts, short circuit levels may be permitted to be in the 250,000 kva. class with good economy which will allow about 12,500 kva. to be normally handled per bus section.

At an operating potential of 13,200 volts, short-circuit interrupting abilities of 250,000 and 500,000 kva. are commonly used and momentary current requirements are not restricted at either

New Series Capacitor Protective Device

A capacitor connected in series with an electrical circuit improves its voltage regulation by inserting a negative reactance which in effect cancels all or part of the inductive reactance of the circuit. An installation usually consists of a bank of capacitors connected in series with each phase of a transmission or distribution line, each bank having the reactance necessary to cancel the desired portion of the phase reactance and designed to handle the maximum continuous and momentary line currents.

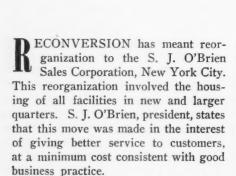
Capacitors may be subjected for brief periods to twice their rated voltage without damage to the dielectric; therefore,

[Continued on page 202]

SERVICE

Plant and organization of S. J. O'Brien Sales Corporation, New York City, designed and operated for prompt, efficient sales and service on refrigerators, air conditioning and electrical work.

By Berlon C. Cooper



This Corporation operates as a sales and service organization for General Motors Frigidaire units, including air conditioning equipment. It also embraces an electrical construction and maintenance division, which operates under the name of S. J. O'Brien, Inc.

Previously housed in several separate buildings, all departments are now consolidated in one building. This building, formerly used as a garage by a large trucking firm, was purchased in November, 1945. Six weeks later the building had been completely revamped, and all machinery, furniture and furnishings moved into its 44,000 square feet, ready for operation. Prompt, efficient service is now assured all customers. Work is done on a production line basis, assuring greater efficiency and lower costs.

During the war years, in addition to servicing refrigerators and doing electrical construction and maintenance work, Navy work was done on a subcontract basis. Approximately 500 men assembled switchboards for the Navy, and 200 men were kept busy on electrical repair work for ships, including the Queen Mary and Queen Elizabeth.

the Queen Mary and Queen Elizabeth.

The slogan for S. J. O'Brien, Inc., the electrical construction and maintenance division of this organization, is "From a bell to a power house." This slogan aptly tells the story of the type of work being done daily by this department.

Organization

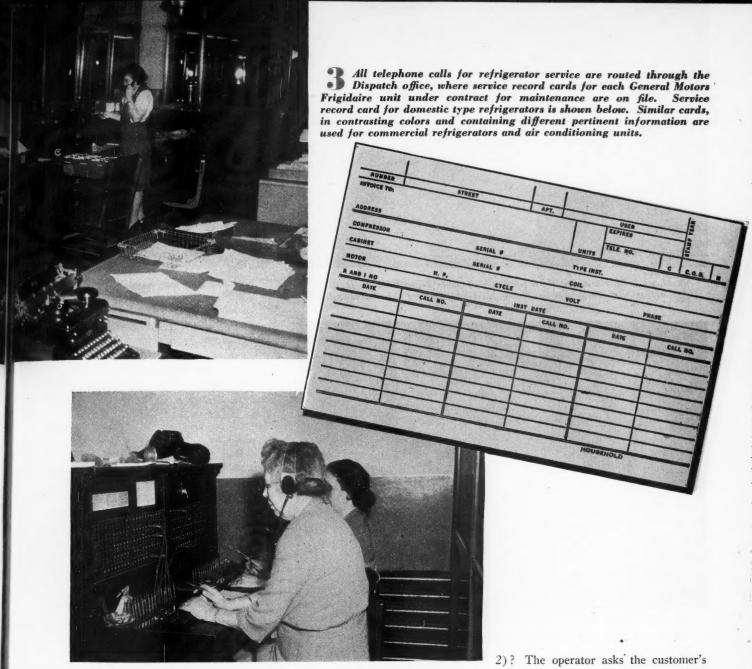
The layout of departments, shown on the first and second floor plans has been planned to increase organization efficiency. Private and general offices are housed on the second floor. A conference room adjoins Mr. O'Brien's office, both fittingly decorated and lighted by Rambusch Decorating Company. The Electrical Construction Department and Contract Maintenance Department are located next to each other, which permits close liaison between these two departments. Lighting for this entire general office area is accomplished with continuous line cold cathode tubing, four tubes per line, and approximately 40 footcandles are provided uniformly throughout.

Located on the first floor of the building is a refrigerator display room, Installations and Engineering Department, the Dispatch Department, offices for



S. J. O'Brien, president, S. J. O'Brien, Inc., and S. J. O'Brien Sales Corporation, has moved both organizations, all shops, warehouses and sales rooms into new and enlarged quarters in one building, to insure prompt, efficient service to all customers.





Two operators are required to man the 36-trunk line telephone switchboard, providing 24-hour service to owners of more than 250,000 refrigerator units in New York City.

Supervisors, Purchasing and Parts Department, Old Service Parts Department, the motor repair shop and Reoperation Department. The entire basement is used for general storage. All operations are thus departmentalized.

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All General Motors warranties for domestic refrigerators sold in New York City are handled by S. J. O'Brien Sales Corporation. Each refrigerator sold in the City is immediately listed on a Service Record card (Photo 3) and filed by zone in the Dispatch Department. The City is divided into six zones for the summer months, and into four zones for the winter months. Service Record cards are refiled by zones for each season. When warranties expire, the Contract Maintenance Department is

promptly notified. It then contacts the customer for an annual contract on maintenance.

Handling Service Calls

Service Record cards, for commercial refrigerators and air conditioning units sold by this corporation, are handled in the same manner. These cards are of a different color in order that they may be readily identified, and contain all pertinent record information. The information is varied from that shown on the domestic type refrigerator, but the cards are the same size and are used in the same manner and filed in the same cases.

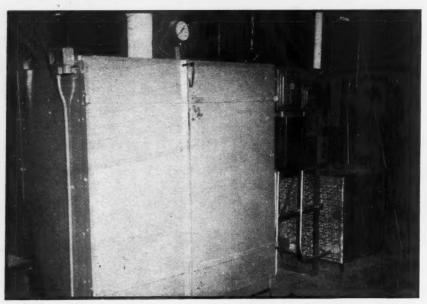
What happens when a service call is received at the main switchboard (Photo

address in order to classify the call by zone. Then the call is transferred to the Dispatch Department (Photo 3) according to zone. The operator in this department then asks the customer for his name and address, in order to check the Service Record file. If the customer is under contract, either on a warranty, or on a contract sold by the Contract Maintenance Department, the customer is advised that a serviceman will call. If the customer has no contract, they are asked for the name of the refrigerator which they have. In most cases it will be a refrigerator of other than General Motors make, and the customer is advised where to call for service. If the customer should own a General Motors refrigerator, the call is transferred to the Contract Maintenance Department. This department will attempt to sell a contract, but will see that the customer is served, in any event.

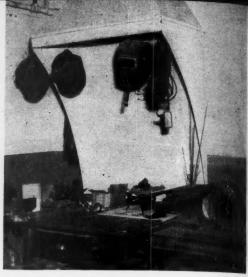
Approximately 100 servicemen, each



Locker bins are built into partition of parts department to facilitate delivery of stock parts to servicemen and prevent counter crowding.



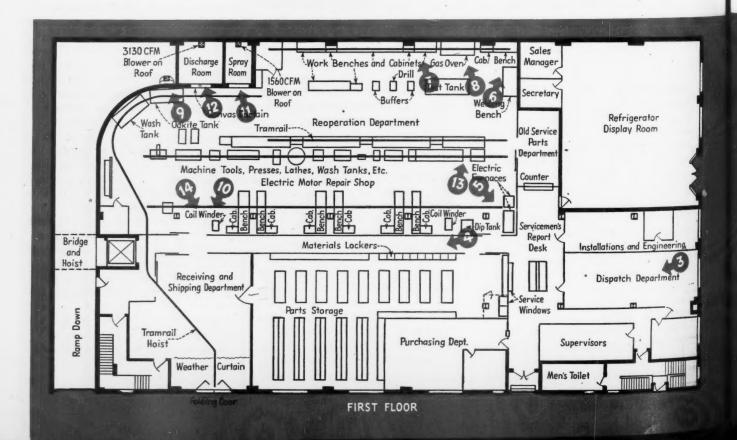
Two electric furnaces, 16 kw. on left, 5 kw. on right, are convenient to motor repair shop and refrigerator Reoperation Department.

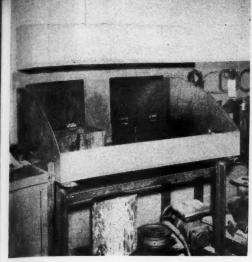


Ventilation hood is provided over welding bench, located in corner of Reoperation Department.

equipped with an automobile, tools, and a supply of parts, cover the city. These servicemen operate under zone supervisors. These servicemen report periodically by telephone to their supervisors, for list of customers and for instructions. They report to the office when necessary to bring in old service parts, or to leave orders for new parts. New parts can be picked up quickly on the following morning after filing an order, from a parts locker (Photo 4) where parts ordered have been placed overnight. This prevents crowding at the Parts Department counter. Lockers can be opened only by a Parts Department employee from a parts locker control panel (pushbutton equipped).

The Purchasing Department uses a perpetual inventory Kardex visible file index to maintain an adequate stock of all parts. It is located adjacent to the

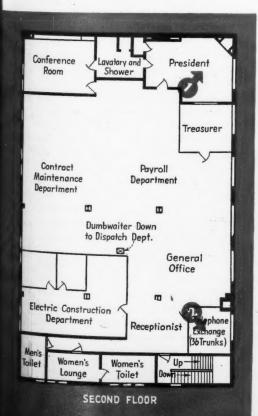


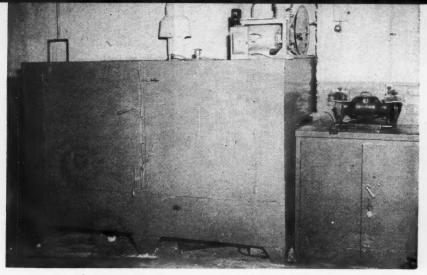


Carbon tetrachloride tank is conveniently located in Reoperation Department. Uote vent hood.

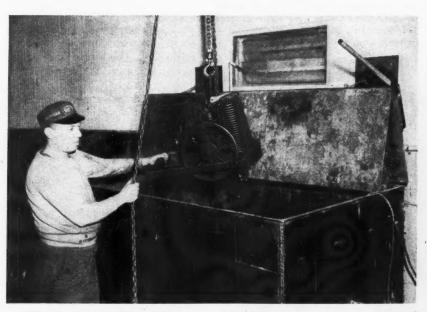
Parts Department for efficient operation. Repair work for both the motor repair shop and reoperation shop are brought in through the Receiving and Shipping Department, or to the ramp and through the freight elevator. All work is delivered to the shop by means of an electric hoist and tramrail (see floor plans). An electrically operated bridge is lowered in the ramp for repair work going to the first floor, or for supplies going to storage in the basement via the elevator. Heavy items are delivered to the basement by truck, after raising the bridge in the ramp.

The motor repair shop and Reoperation shop occupy a large part of the first floor, divided only by a line of cutters, presses, lathes, grinders and work benches. Thus these heavy machine tools are readily available to both shops. The motor repair shop contains seven





Shop is also equipped with gas fired dehydrating oven. Compressor on top is used to pull vacuum within oven. Small cabinet at right is combination work bench and employees' tool cabinet.



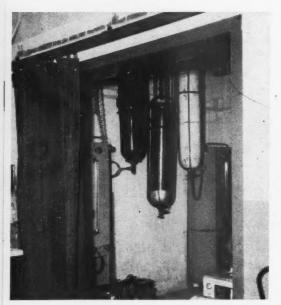
Tank holds Oakite solution, at 180°F., for cleaning dirt and oil from coils and compressors. Counterweight permits heavy lid to be raised easily. Ventilating outlet over tank draws vapors out of room and prevents undue humidity.

A combination work bench cabinet serves as individual locker for employee's tools.





Forced ventilation through ceiling opening near rear wall (1560 CFM) removes explosive fumes from paint spray room. Ceiling panel light, near air vent, is gasket sealed, flood lights over door provide additional light. Note explosion-proof wiring and fittings.



Discharge room is equipped with forced ventilation (3130 CFM, blower on roof) and heavy curtain which prevents refrigerant odors and fumes from penetrating shop.

Tank contains non-flammable solution for cleaning motor parts. Note blow torch in background. Pump (lower left) forces solution through spray nozzle under pressure.





Test panels for coil winders are conveniently located on columns over work benches. A-c, d-c, 110 v. and 220 v. power is available on each panel.

work benches, each complete with test board, tools, etc., for coil winders. A wash tank (photo 13), containing a special non-irritant, non-flammable liquid is used to clean motor parts after disassembly. Two electric ovens, (Photo 5), one of 16 kw. capacity, and one of 5 kw. capacity, are conveniently located for use by either shop.

The Reoperation shop is adequately supplied with equipment and facilities required in the repair of refrigerators not including electric motors. A wash tank, Oakite tank (Photo 9), discharge room (Photo 12), spray room (Photo 11), carbon tetrachloride tank (Photo 7), dehydrating oven (Photo 8), welding bench (Photo 6) and coil test tank are all conveniently located for production line flow of work.

The twelve foot long coil test tank is filled with water and underwater lighted from either end. Coils are submerged in the water and filled with air under pressure. Leaks are thus quickly located, by tracing the illuminated air bubbles.

The Oakite solution in the Oakite tank, used for cleaning dirt and grease from coils, fans, etc., is maintained at 180° F. temperature (Photo 9). An immersion gas heater is used to heat this solution. A heavy 300 lb. lid on this tank is kept closed except when the tank is in use. A counterweight permits the lid to be opened or closed easily by hand. Vapor from the hot solution is drawn from the room through a ventilator over the tank, powered by a 1560 CFM exhaust fan located on the roof of the building.

A unique arrangement in the discharge room, where coils are filled with refrigerants, is a heavy canvas curtain which is pulled over the door when the room is in use. A 3125 CFM exhaust fan on the roof pulls all vapors from this

room through a ceiling ventilator at the rear of the room, even when the refrigerant is spilled on the floor.

The paint spray room is equipped with explosion-proof wiring and lighting. Fumes are drawn from this room through a ceiling ventilator by a 1560 CFM exhaust fan, also located on the roof.

Ventilators are provided over the carbon tetrachloride tank and over the welding bench, so that all fumes, vapors, smoke, etc., are drawn from the room at the point where created. This keeps the shop clean, and makes for good working conditions. An intensity of approximately 25 footcandles of illumination is provided throughout the main shop area. Industrial type fluorescent units, each equipped with two 40 watt white fluorescent lamps, are used in this area, installed ten feet from the floor on approximately nine by nine foot spacings.

Employees in the Old Service Parts Department carefully inspect all parts returned to them. Worthless parts are discarded. Parts guaranteed are returned to the manufacturer for replacement or refund.

Commercial refrigerators and air conditioning equipment are displayed in the attractive show room, open to the public. The history of refrigeration adorns two walls in mural treatment, and a large airplane view of the General Motors Frigidaire plant covers the third wall. This room is lighted to 50 footcandles with four-lamp 40 watt continuous line fluorescent fixtures of the V-shape diffusing glass type, manufactured by Gruber Brothers.

Different types of lighting have been used in the various departments purposely, in order that the electrical construction department may use the entire building lighting as a display, in selling lighting to prospective customers.

Electrical Contracting, March. 1946

Residential Wiring

A NATIONAL objective of 2,700,000 homes in two years, an estimated 1,000,000 homes a year for at least 10 years, an all-out industry adequate wiring campaign in practically every city in the country and a tremendous backlog of demand for modern electrical appliances are creating a market for residential wiring beyond any past experience. Not only in the over-all magnitude of the market, but in the wiring job in the individual home, it becomes difficult to measure and design on the basis of past standards and practices.

This editorial project is designed to provide an up-to-date picture of house wiring. In the following pages are the electrical plans for wiring and lighting a modern electrical home. In this home we have brought together a maximum number of modern ideas and methods which are directly applicable to any home wiring plans.

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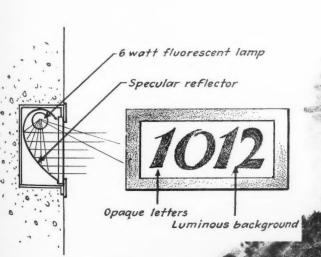
There has been no attempt to develop here the "home of the future" or to project imaginative ideas, however interesting or logical. There are provisions in service and feeder capacities for moderate load additions. There are numerous and convenient plug receptacles. But the wiring and lighting systems shown are practical and geared to the appliances, apparatus and lighting components now being manufactured for the home.

It is important to note that many of the new electrical appliances are heavy loads requiring special circuits and ample service and feeder capacity. Many of the new portable appliances also operate at higher wattage than older

types. Wiring systems have been so notoriously skimped to bare minimum in the past that it is not surprising to find feeders much larger than is usually considered conventional for average homes and many more than the usual number of branch circuits. Home wiring has not kept pace with the development of lighting and appliances. War time restrictions held it to a "bare-bones" minimum. The market ahead, consequently, for house wiring is radically different. Adequacy for 1947 is a long step indeed from adequacy in 1937.

In this modern electrical home the service conductors are underground. As residential services grow larger, services and utility secondaries must eventually be concealed.

Load distribution is conventional. The main distribution panel contains six circuits serving major appliances and



ILLUMINATED HOUS

Illuminated house number consists of control as a luminous background. Unit is housed in me a special also serves as a junction box for electrical services as a junction box for electrical services at switch control is located inside the front door. Other electrical features at front entrance includes ornamental bracket light, shielded step light, fluorescent lamps under terrace bench, weatherproof convenience outlets, and sound communication system.



Electrical Contracting, March 1946

load centers. Feeders extend to a basement panel, serving the laundry, food storage and basement lighting, a first floor panel serving the kitchen appliances and first floor lighting, and a second floor panel serving bathroom heater, lighting and plug receptacles.

No details are shown of the wiring system materials since the general layout of circuits follows conventional wiring practices. Any of the approved systems, conduit, tubing, flex, armored cable or non-metallic, depending upon local practices and rules, are adaptable. It is recommended, however, if non-metallic cable is used, that circuits feeding major appliances in the laundry and kitchen be provided with separate conductor for grounding appliance frames.

Minimum conductor size is No. 12 throughout. Home runs are brought to switch or receptacle locations wherever practical, and the use of large boxes, 52171 and 72171 types, are recommended at these points. There is a substantial advantage, both from the standpoint of original installation and maintenance, in standardizing on the larger boxes for all switch and receptacle outlets, limiting the use of the standard switch box to places where space is limited.

Plug receptacles in those rooms where portable lamps are used are arranged on a split circuit, the upper half of the duplex receptacle is switched, the lower half is hot. Plug-in strip in the living room is also switch controlled. Closet lights are controlled by door switches. In general, all lights which must be turned on and off are controllable with conventional wall switches without resorting to the individual pull chains of local switches. No switch control is included for the night lights which are tiny low wattage lamps intended to remain lighted round-the-clock.

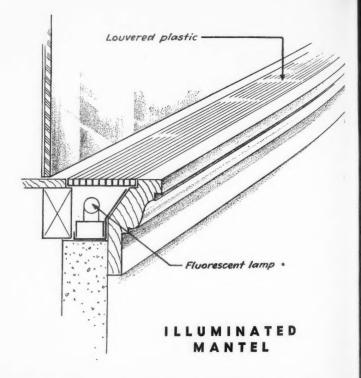
Circuits are provided for an air-conditioning system, deep freezer, laundry dryer and garage door operator, bath room heaters and similar equipment which will be widely used in new homes. In the early stages of home construction many of these may not be available. It is important, however, to incorporate the necessary feeder capacity and circuits in the original wiring installation whenever it is reasonably possible that such equipment will be eventually installed. The cost of even high capacity circuits tied in with the original wiring job is very modest compared with the cost of adding such capacity to inadequate service, distribution panel and feeders in the future.

Since our effort here is to incorporate as many practical wiring ideas as possible, the overall standards of this home are substantially higher than those of the Handbook of Interior Wiring Design, and the standards of the National Adequate Wiring Bureau. All of the ideas shown are not necessarily applicable to the average home, some are definitely in the luxury class. Any of them may be incorporated, however, within the average home where the wiring is planned on the basis of adequate wiring standards.

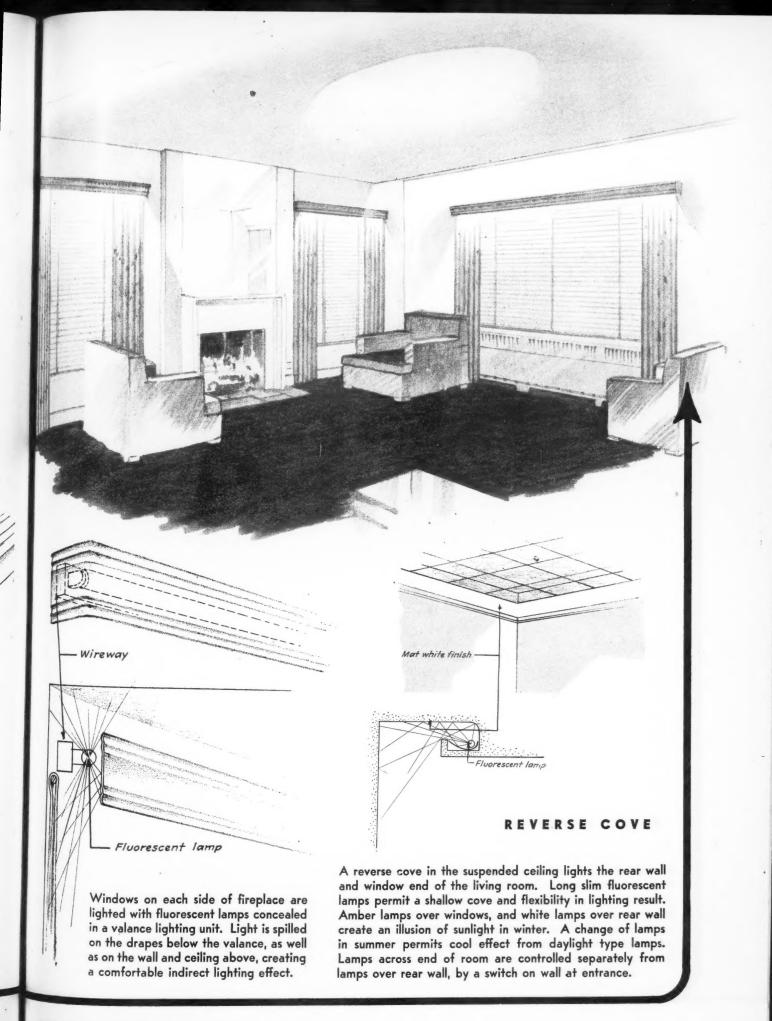
A major part of this editorial project is devoted to inbuilt lighting ideas. Here is a fertile field waiting for aggressive industry development. Little has been done in recent years to bring modern lighting technology into the home. Here we show a number of lighting schemes planned for living based upon the use of modern light sources and methods. It is safe to predict that the most revolutionary change in house wiring in the coming years will be in the application of inbuilt fluorescent lighting.

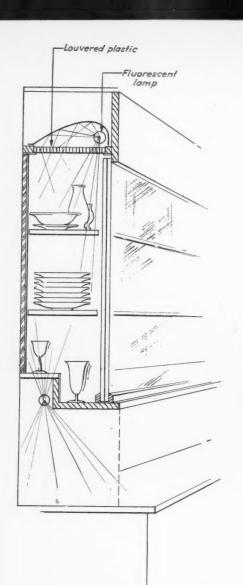


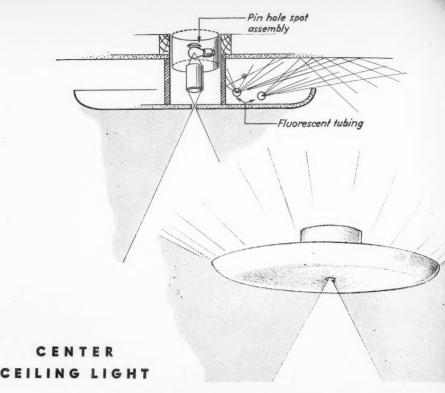
Center of living room is accented with cheerfulness with a soft glow of light from an indirect lighted coffer. Circular cold cathode tubing in this coffer is of proper color to blend with color of furnishings in the room. Dome of the coffer is finished flat white, to produce uniformly lighted appearance and prevent reflection of the tubing. Transformer for the tubing is concealed above recessed ceiling behind the cove, and is controlled from wall switch.



A continuous fluorescent tube is concealed in the mantel over fireplace in the living room. A panel of clear plastic containing closely spaced louvers shields the lamp from persons standing in the room. Ornaments placed on the mantel are lighted softly, and a pleasant indirect lighting effect on the ceiling over the mantel results. This unit is wall switch controlled on the same switch with the valance lights over the two adjoining windows.





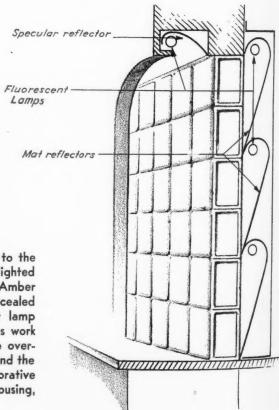


The center dome in the dining room serves two purposes. It provides indirect lighting from two curved fluorescent tubes, one soft white and the other 3500° white, which supplements the indirect lighting from the side wall lighting troughs. It also conceals a pin hole spotlight, installed and serviced through a trap door in the floor above. It is used to highlight the table. Each lighting effect is separately controlled by wall switches.

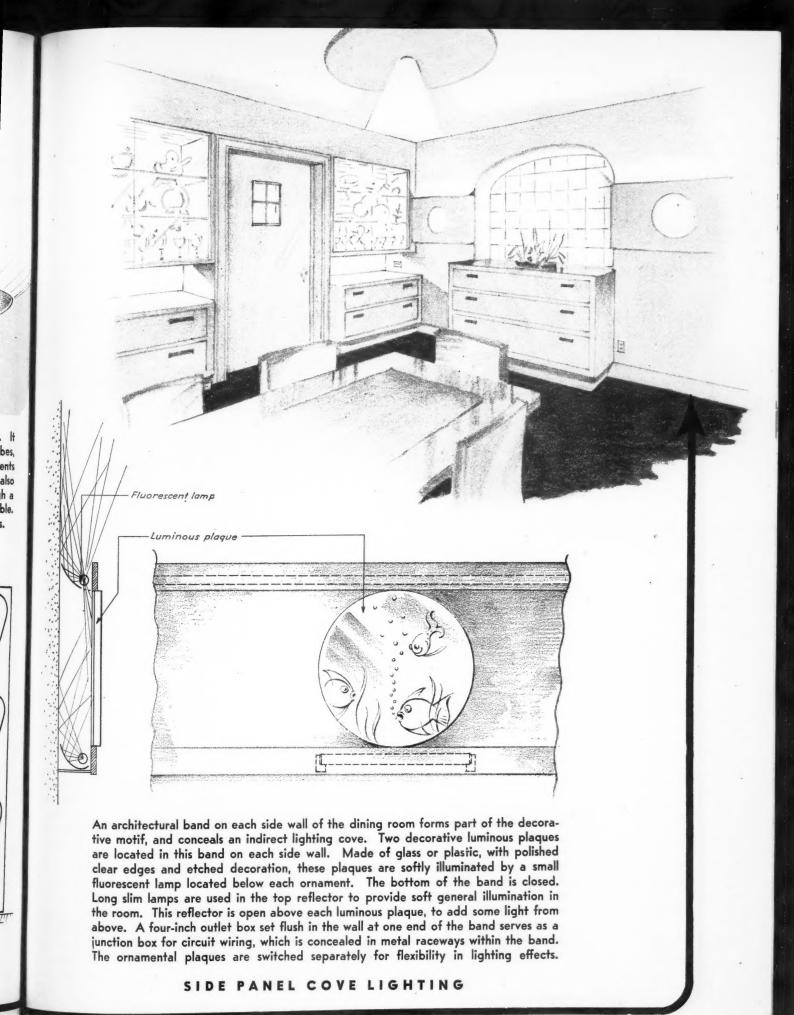
ILLUMINATED CABINET

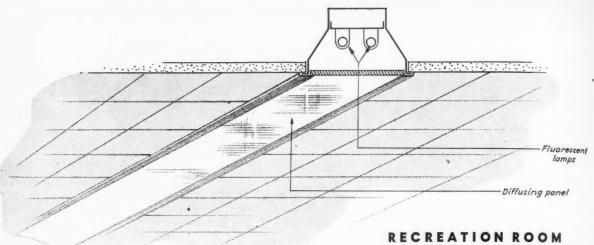
The dining room wall next to the kitchen contains a built-in glass shelf cabinet, with mirror backwall. This cabinet is lighted from both top and bottom by white fluorescent lamps. Overhead lamp is concealed behind a wide panel of plastic containing closely spaced louvers. The light from the bottom lamp shines up through the glass shelves, and also down on the table top over the bottom cabinet drawers. The wall switch control permits these lights to be used in conjunction with the other dining room lighting, or separately, as desired.

Glass blocks are used in the dining room side wall next to the garage, to form an artificial window. The blocks are lighted from the garage side of the wall, to simulate sunlight. Amber fluorescent lamps are used in mat finished reflectors, concealed in a metal or asbestos lined cabinet. A fluorescent lamp in a polished reflector in trough recess at top provides work light, or supplementary decorative lighting effect. The overheadlight light is switched separately from the lights behind the glass blocks, to provide flexibility in lighting and decorative effects. Soffit reflector is self-contained in a metal housing, which forms its own wireway and junction box.



ILLUMINATED GLASS BLOCK WINDOW

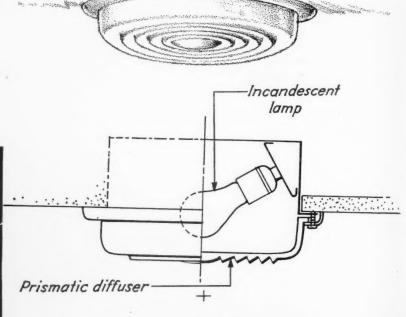




CEILING LIGHT

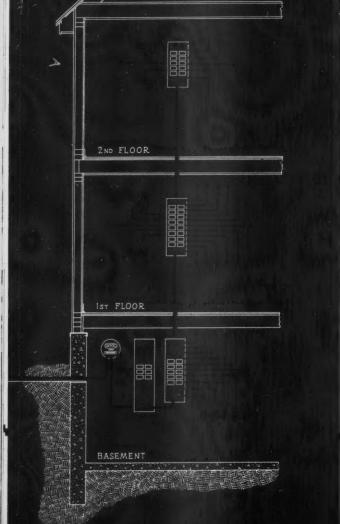
Recreation room in basement is lighted with continuous troughs containing long slim lamps, installed flush in ceiling. Flashed opal glass panels with exposed surface satin finish conceals lamps, diffuses the light, and prevents reflection of lamps from indirect floor and table lamps used for indirect lighting. These troughs provide high level lighting for games, such as table tennis and darts.

> RISER DIAGRAM



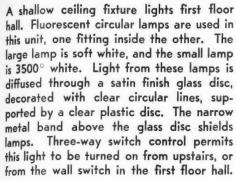
FOYER LIGHT

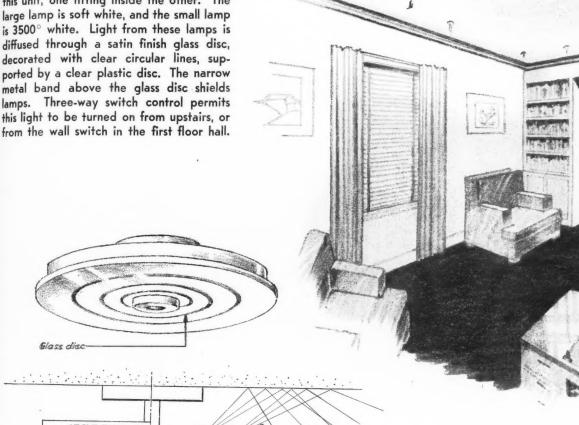
A semi-recessed unit with a 60 watt incandescent lamp produces a warm glow of light in the entrance hall. Its pressed glass bowl, supported in a plain hinged rim, has a concentric prism bottom. Inner prism surfaces may be finished in color to match decorations, without distorting the color of the light. Metal drum recessed in the ceiling is finished white inside and houses lamp socket and wiring compartment. Unit is switched from wall inside the front door.



Adequate wiring includes multiple circuits to guarantee the safety and convenience of both present and future demands. Diagram indicates underground service passing through the meter to main distribution panel, branch load centers and circuits. Minimum conductor size is No. 12 throughout.

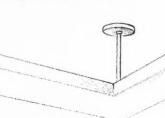
Residential Wiring

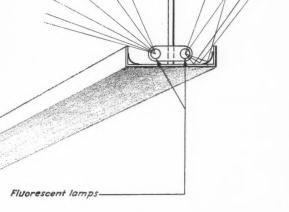




HALL LIGHT

Uniform glareless illumination from an indirect trough makes the study an ideal place to read or work. Supported at each of the four corners, the trough, rectiliner in plan, uses two 72-inch slim fluorescent lamps in each of the four lengths. The bottom of the trough and canopies and stems are finished to match the ceiling, while the sides of the trough are finished to match the walls. The four ballasts are housed in the closet in a metal cabinet. Circuits from ballasts to lamps are fed through two standard four-inch outlet boxes and the suspension stems at support points adjoining the closet wall.

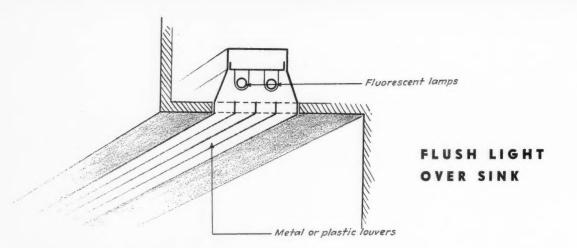




Circular Fluorescent lamps

INDIRECT TROUGH IN STUDY

ing ing ing



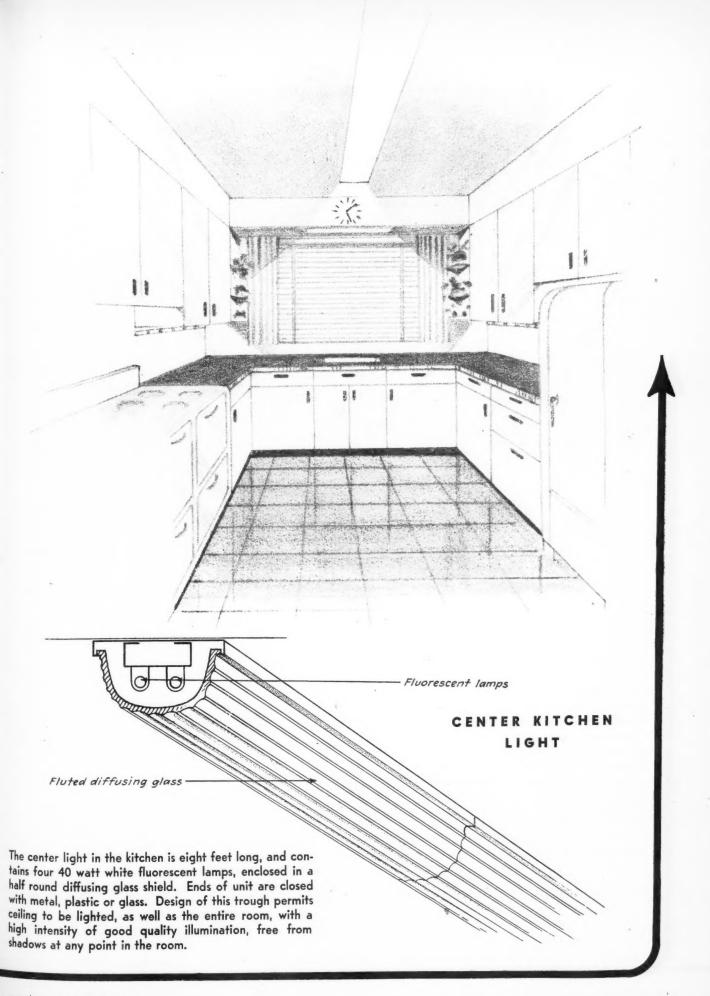
A two-lamp fixture, equipped with 4500° white fluorescent lamps, is installed flush over the kitchen sink, and louvered, to provide shielded high intensity light of good color quality for this work area. Unit is turned on with center ceiling light from three separate wall switches, located adjacent to the three doors to the kitchen. These four-way switch controls provide added safety and save many footsteps. An electric clock is flush-mounted centrally in the vertical face of the masking box-valance. The clock is connected to a hot circuit.

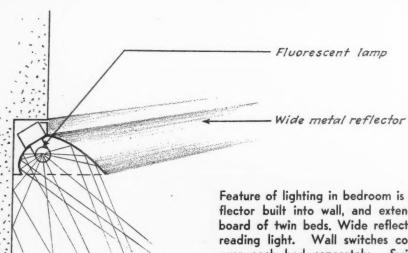
convenience outlets in wiring strip

d color quality the kitchen by nstalled under-clectric service row, and other available from very six inches wall above the

High-level illumination of good color quality is provided for work areas in the kitchen by 4500° white flourescent lamps installed underneath the overhead cabinets. Electric service for toasters, mixers, percolators, and other kitchen appliances is readily available from convenience outlets installed every six inches in the wireway located on the wall above the table top.

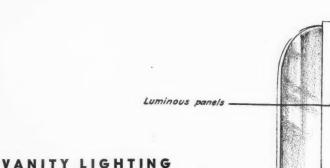
CABINET LIGHT and CONVENIENCE RECEPTACLES



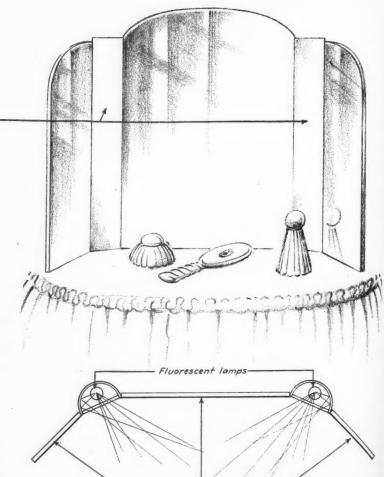


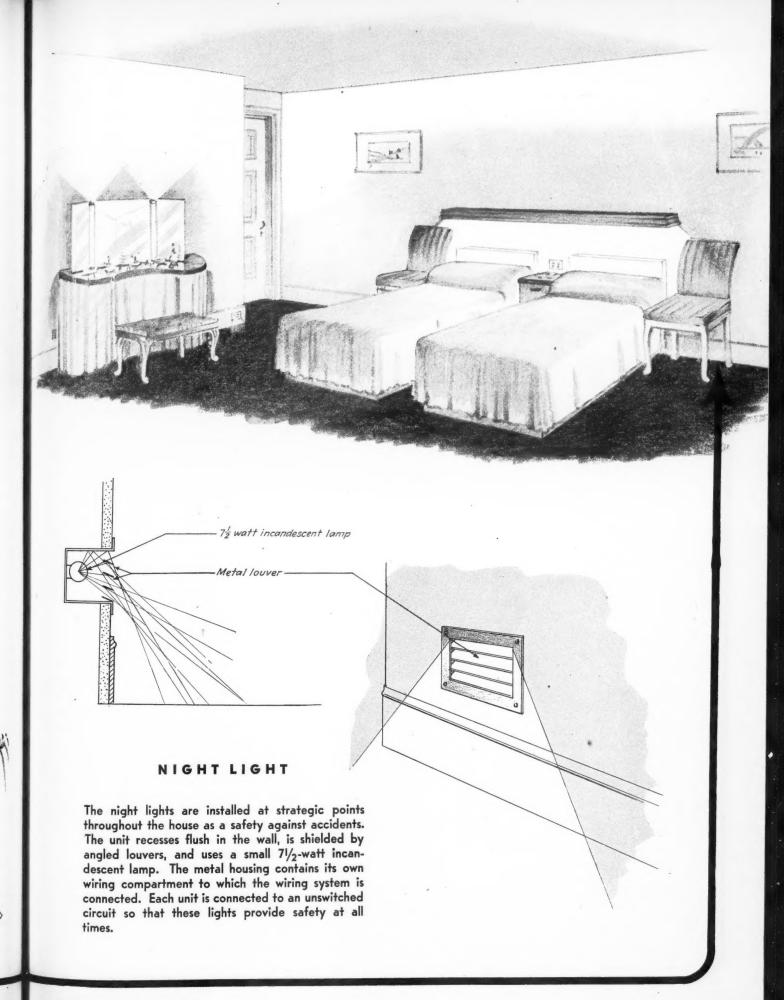
Feature of lighting in bedroom is a continuous metal reflector built into wall, and extending across the headboard of twin beds. Wide reflector provides ideal bed reading light. Wall switches control fluorescent lamp over each bed separately. Switches conveniently located on wall between beds also control one circuit to convenience receptacles, the center ceiling light, and circuit No. 8 on the first floor. This master control of circuit No. 8 located in the bedroom, feeds all exterior lighting brackets, permitting entire yard to be flooded with light. It is used as a safeguard against prowlers.

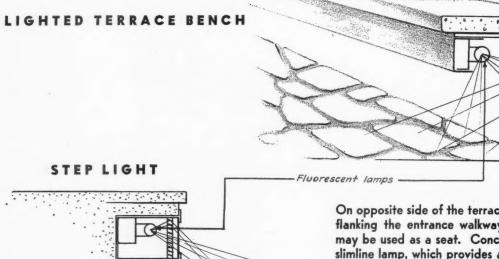
BED LAMP



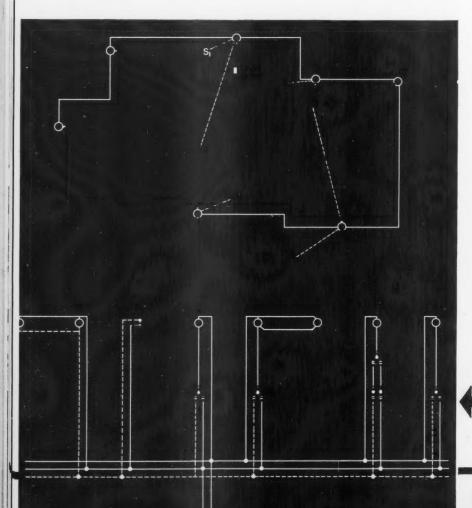
The dressing table in the bedroom is effectively self-illuminated from two luminous panels built into the three-panel mirror. Soft white fluorescent lamps are concealed in reflectors behind diffusing glass panels which provide long sources of light from two directions. Face shadows are completely eliminated. Current is supplied through a flexible cord which is plugged into the wall-switched convenience outlet behind the vanity table. Two tall portable lamps, one on each end of the dresser table, will also provide similar lighting results.







The front door contains a recessed light underneath the entrance step, which floods the walkway with light. A 13 watt T-5 fluorescent lamp provides the light, which is shielded from above by louvered plastic, installed behind clear glass. The entire unit is enclosed in a metal housing, which forms the junction box for electrical service. The wall switch for this unit is located in the entrance hallway.



On opposite side of the terrace from the house, and flanking the entrance walkway, is a low wall which may be used as a seat. Concealed underneath is a slimline lamp, which provides a soft glow of light on the terrace and on the front of the house, making the terrace an ideal spot for summer evenings.

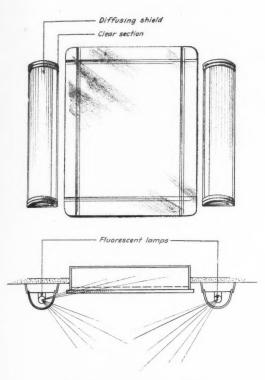


YARD LIGHT

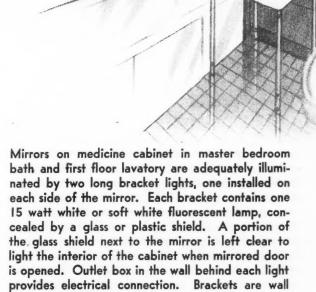
Light over the garage door, and on rear corner of the garage, combines a prismatic glass globe with a simple bracket arm. The prismatic glass globe is used to provide a wide spread of light over the driveway and yard. The unit over the garage door may be turned on or off from a key-operated switch on a driveway post, or from a switch at the rear door to the garage. All exterior bracket lights may be turned on from a master switch located in the upstairs bedroom.

Circuit No. 8, first floor panel, is used for all exterior lighting brackets, including floodlights located under the eaves of the roof over second floor (A and B). A master control switch for this circuit is located in the master bedroom. Diagram at left shows wiring hook-up for controlling these exterior lighting units.

Residential Wiring



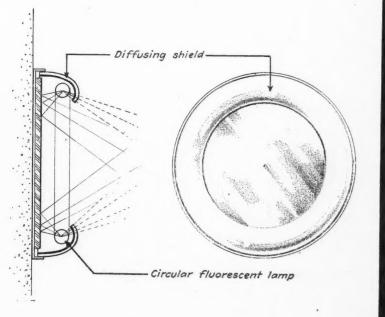




switch controlled for added convenience.

ILLUMINATED MIRROR

The circular make-up or shaving mirror in the guest bathroom is appropriately lighted with a circline lamp, concealed behind a luminous shield which eliminates glare and minimizes surface brightness of the lamp. Ballast for the lamp is installed behind the mirror in a circular metal housing, which attaches to a standard 4 inch recessed outlet box. Switching is by means of wall switch at entrance door. The reflection of glareless light evenly from a face-framing circle completely eliminates under chin shadow while shaving. Plugin outlet for electric razor or curling iron is centrally located beneath the mirror.



WIRING DIAGRAM

ONL

FIRST

FLOOR

S3 (Up)

ONL

\$ \$ \$4

QNLY6

S4 (Down)

WP

QWP QHN

DO

To Key Switches on Driveway Post

RESIDENTIAL

Electrical Contracting

(To 2nd Floor Exterior Lights)

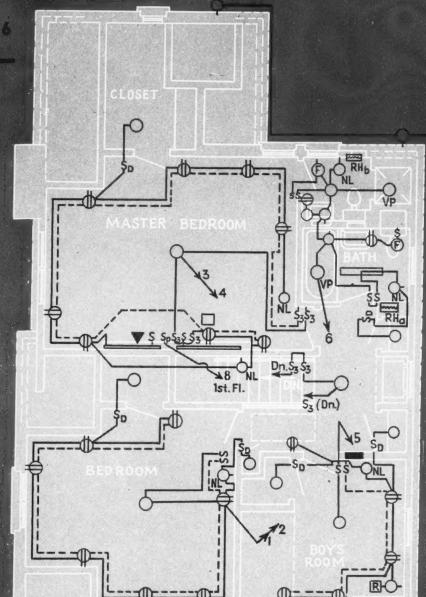
To Garden

O -Ceiling outlet

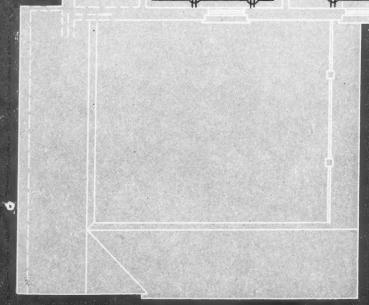
- -O -Wall outlet
- B -Blanket ceiling outlet
- ⊕ Fan outlet
- -© −Clock outlet in wall
- → -Duplex convenience outlet
- Ovp-Ceiling outlet for vaporproof lighting unit
- Owp Weatherproof bracket
- ₩p Weatherproof convenience outlet
- ⇔R Radio and convenience outlet
- Floor outlet
- -O_{NL}-Night light (flush in wall)
- -Push button

LEGEND

- √ -Call phone
- ▲ -Telephone outlet
- å −Bell
- ☐ -Buzzer
- -Panel
- -Fluorescent tubing (straight or curved)
- ____-Lighting fixture
- -Branch circuit
- ----Switch control on con venience receptacle
- →→ -Home bus to panel boot
 (No. arrow indicate number of circuits)
- -mr Convenience receptore in continuous wireway
- X Spare circuit



Ckt. No.8 First Floor



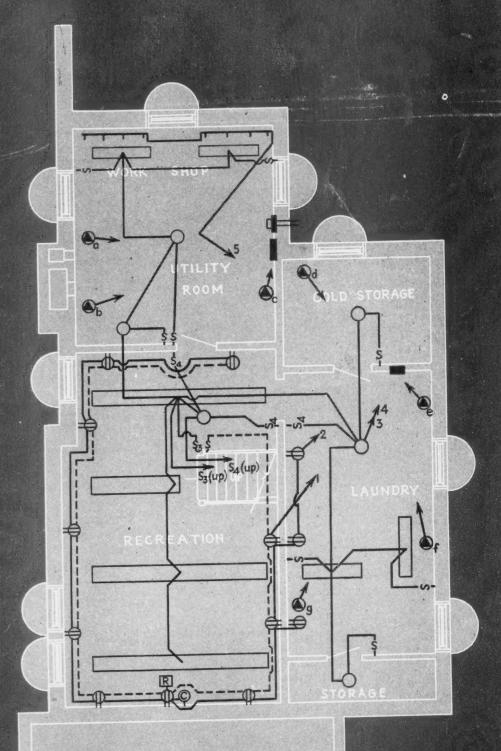
n con stacle I board te its)

SECOND FLOOR

SPECIALS CIRCUITS

- ⊕a -Air conditioning
- ♠b-Furnace
- Oc -Hot water heater
- ⊘_d -Cold storage freezer
- Oe -Washing machine
- Of -Dryer
- Og -Ironer
- **⊕**_h -Dishwasher . .
- Oj -Garbage disposed
- ♠ -Refrigerator
- ♠m-Garage Door
- ⇒R-Electric Range
- RHa -Radiant heater (1500 watts)
- RHa -Radiant heater (2000 watts)
- S -Single Pole switch
- S₃ -Three way switch
- S4 Four way switch
- Sp -Switch and pilot lamp

WIRING DIAGRAM



UNEXCAVATED

Residential Wiring

Electrical Contracting, March, 19

BASEMENT









The Tuffernell line includes a complete selection of Fiberglas tapes, tying cords, sleeving. Illustrated here are coils wrapped with Fiberglas tape.

Fiberglas is an exceptional member of the Tuffernell line of insulating materials...it offers...

- greater HEAT PROTECTION... added protection against higher temperatures when an overload occurs.
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- greater SPACE ECONOMY . . . less Fiberglas is required to obtain the proper insulation protection.
- greater DIELECTRIC STRENGTH . . . tests prove that properly impregnated Fiberglas has higher dielectric strength than most other varnished textiles.

These advantages have been proved by the increasingly extensive use of Fiberglas in the electrical industry.

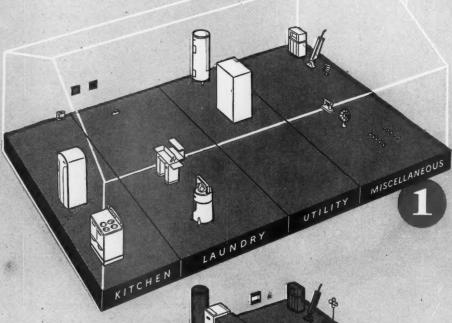
Call your nearest Westinghouse office for complete information about Fiberglas products and others in the Tuffernell line. Ask for an insulation specialist. He'll be glad to help you. Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

J-06391

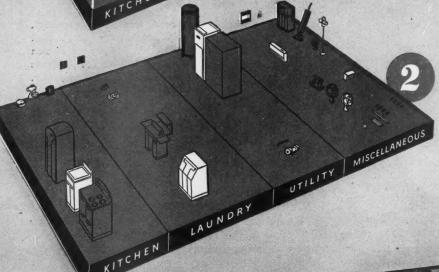


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1 degrees



Thrift Degree—the minimum standard for Electrical Living. Includes appliances, equipment and lighting shown.



Budget Degree—more equipment and automatic features are added to the Thrift standard. Additions include a dishwasher, home freezer and Laundromat.

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FREE. Four Degrees of Home Electrification for Electrical Living. Gives full information on basic equipment and wiring requirements. Home Wiring Handbook. \$1.00. Complete technical information on wiring systems for Electrical Living. 120 pages. Dozens of charts and tables.



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to boost profits, sell these four degrees

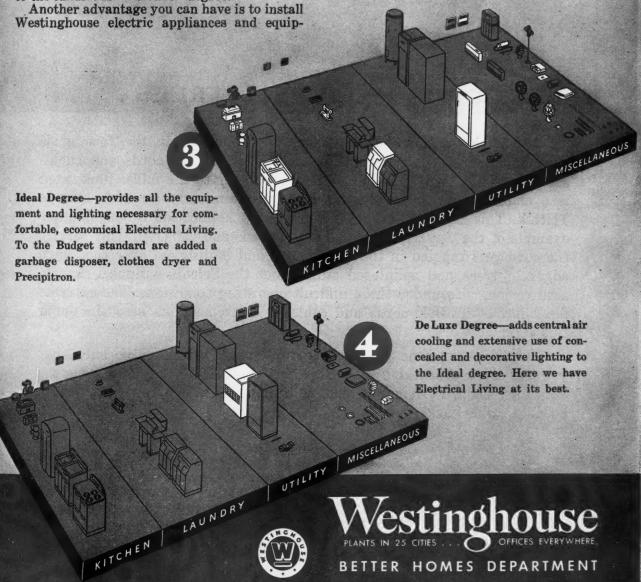
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By introducing Four Degrees of Electrical Living, Westinghouse makes it possible for any home to enjoy Electrical Living, opening up new groups of prospects for Better Wiring. The Four Degrees range from "Thrift", the minimum standard of Electrical Living . . . up to the luxurious "De Luxe" degree.

Another advantage you can have is to install Westinghouse electric appliances and equip

ment on your jobs, plus quality wiring devices by Bryant. These widely known products immediately establish the quality of your installation and are a guarantee of satisfactory service.

For your free booklet, write Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa. Send dollar for Handbook to Westinghouse Electric Corp., Extension Training Department, Pittsburgh 30, Pa. J-91560





With a serious housing shortage staring us in the face, it is good to know that dependable products like TIREX cords and cables are being used to help speed the flow of timber to the mills. Illustrated is a chain saw with an electric drive. Of course the portable cord is TIREX. This rather unusual and interesting application is just another example of the versatility of all TIREX cords and cables. In this service the cord gets tangled in the underbrush and is dragged over the sharp edges of trees and splintered stumps but the Selenium Rubber Armor assures long life under these difficult operating conditions. The extreme flexibility of TIREX cords and cables is a tremendous asset in doing this kind of work.

The next time you need portable cords or cables be sure that you get a cord or cable marked "Simplex-TIREX", the one with the Selenium Rubber Armor which is the toughest, most wear-resistant cord or cable jacket known.



BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

PRACTICAL METHODS

COFFERDAM METHOD FOR VAULT CONSTRUCTION

CONSTRUCTION

On a government project, recently, the Stetson Electric Co., Los Angeles, had a contract which included the construction of 30 double vaults and manholes for light and power and telephone service, of dimensions shown in Fig. 1. The soil was sand, with water seven to eight feet below the surface.

Another contractor was constructing similar vaults in the same general area, making an excavation completely around each pair and then building forms completely around each vault, the general contour of the excavation being shown in Fig. 1.

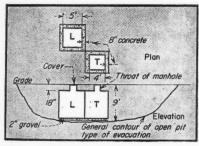


FIG. 1—Plan and elevation of typical vault and manhole, with contour line showing approximately the extent of an open hole excavation.

Noting the large amount of excavation and subsequent backfill, necessitated by the flowing sand, Stetson Electric decided to employ other means as suggested by two of their employees, Frank Yeager and Jay Reynhart, old-time underground construction men. The method they employed is indicated in Fig. 2.

A square of wood sheeting, provided with shoes, was first driven by "Jackhammers," surrounding the whole area like a cofferdam. The sheeting was first driven clear to water and the enclosed material excavated by clamshell bucket. The sheeting was then driven the rest of the way and the excavation completed, what seepage there was being easily removable by a small pump.

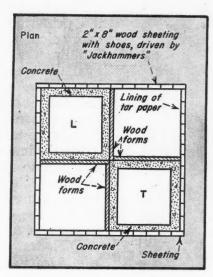


FIG. 2—Plan of Stetson method, by cofferdam, utilizing the enclosure to make the forms for two sides of

When the excavation was completed, the inside of the sheeting was lined clear around with tar paper up to the throat line of the manhole, forms for the latter and the top of the vault being constructed separately. That left only four side forms to be constructed as against eight by the other method. To prevent any lateral movement of the sheeting, the enclosure was reinforced top and bottom by a square frame of 4 by 4's.

Stetson's figure that they saved at least one-half on excavation and backfill by their method. Disregarding throat forms, necessary by either method, they saved about one-half on form construction, the time necessary to line the cofferdam with paper being small. They also saved in the matter of pumping, since the seepage into the cofferdam was a small factor as compared to the volume of water flowing freely into the much

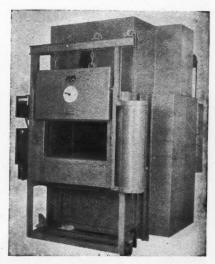
larger excavation.

Only three sets of sheeting were employed on the 30 holes, the sheeting being pulled and used over and over. The investment in this and the cost of driving could be balanced favorably against the amount of form lumber and the time required to build the extra side forms by the other method.

MOBILE PREHEATING FURNACE APPLICABLE TO SHEET FORMATION

A compact, portable furnace eliminated a complicated arrangement for the preheating of magnesium sheets at the Consolidated Vultee Aircraft Corporation, Benbrook, Texas. Process expediency demanded that magnesium sheets be preheated to closely regulated temperatures and delivered to variously located presses for forming. To solve the problem, a portable furnace, mounted on casters to facilitate moving it to the designated brake presses, was designed by the Despatch Oven Company, Minneapolis, Minn.

Heat is introduced from both the top and bottom of the furnace and recirculating ducts on both side walls maintain a temperature uniform within 5 degrees F. This side emission of heat allows even heating of the sheet regardless of its shape and, when neces-



Self contained mobile furnace can be rapidly located and connected in proximity to metal presses employed in processing. Counterweighted doors automatically seal on closing to prevent thermal radiation from furnace to operator. Side vents for heat emission guarantee even heating of sheets re-gardless of shape of metal.



more and more electricity

The floors of this building are so designed that tenants are stimulated to make greater use of electrical facilities.

These are Q-Floors—built and sold on the principle that the whole floor and every floor should be electrically alive. Buildings with Q-Floors use electrical availability as a rental argument for prospective tenants. In a Q-Floor building, the electrician is in greater demand because tenants expect to remain electrically up to the minute.

Every time a new outlet is needed every time floor layouts are changed, an electrician is called. And Q-Floors, because they are designed around and for the use of electricity, tempt tenants to request changes often.

Q-Floors promote more and more electricity.

H. H. ROBERTSON COMPANY

2400 Farmers Bank Building, Pittsburgh 22, Pennsylvania



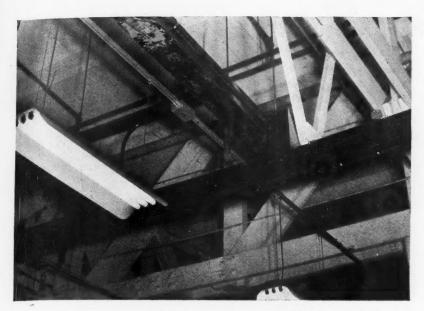
Offices in 50
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Electrical Fittings for use with Robertson Q-Floors can be obtained from General Electric Construction Materials distributors. See the nearest G.E. merchandise distributor for information on how Q-Floor fittings can be used to attain up-to-the-minute electrical wiring.

THIS IS I SQ. FT.

OF Q-FLOOR

)-FLOORS



Offset tee connection permits junction of two feeder bus ducts in Indianapolis. Construction obstacle prevented ducts from lining up in the same plane. Small junction box with double-offset bus bars (two up in the trusses at General Motors Corp., Allison Division Plant No. 5 90 degree bends) effected awkward feeder tie.

sary to transport partially formed sheets between progressively required presses, this feature is appreciated. Speed of preheating is increased by using an oversized fan capable of producing 40 air changes per minute.

The unit is designed for electrical heating although construction alterations will permit the use of either gas or oil. A maximum temperature of 650 degrees F. can be obtained and maintained by the oven. Flexible connections allow rapid hookup changes from outlets most convenient to required locations.

Vertical lift doors at each end of the furnace permit easy and rapid handling of the sheets, reducing the interim cooling interval between furnace and press. Doors seal on closing to keep the heat from the operator and improve thermal efficiency.

ate the production machines. In practically every stage of brickmaking from the conveyor carrying raw material from the storage sheds to the mixers right on through to loading the finished products in freight cars with electric trucks, you will find motors at work.

Selection of the proper type of motor is unusually important because practically all of the machinery must be started under load and requires high starting torques. And, because of bad dust conditions, bearings, slip rings and commutators on the motors should be protected from abrasive wear. The control equipment is comparatively simple and should be conveniently located so the operators have easy and quick access to it. It should be enclosed in dust proof cases.

Because of the nature of the products

and the process, brick and tile plants are usually spread out over a wide area. Much time and labor can be saved if some system of intercommunicating telephones, code calls or other bell or horn signalling devices are installed.

Since a number of motors in this type of plant may be located quite a distance from the distribution center, voltage drop should be given first consideration in circuit design. The high ambient temperatures existing in these plants also have a very important bearing on wire capacities.

For those who may be called on to do electrical work in brick and tile plants, the following check list of equipment should prove a useful guide.

WIRE REEL PAY-OFF HOLDERS

WIDING

The Pacific Electrical & Mechanical Co., Inc., Los Angeles, has designed and built two devices for handling wire and cable reels on the job. Both are easily portable and adapted to various sizes of reels.

The first device, see Fig. 1 and Fig. 3, consists of two independent levers made of $2\frac{1}{2}$ inch pipe about 8 feet in length. To one end of each is welded a steel arm at right angles. In the outer end of each arm an opening is made for insertion of a ball bearing assembly. A steel shaft is passed through the reel and the ends are inserted in the bearings while the levers are raised to a sharp angle. Using a man on each lever, the latter are forced down to the ground, the bearings, traveling through the rising arc being raised sufficiently to clear the reel from the ground. When the levers are down, pieces of smaller diameter pipe are thrust part way into the large pipe ends, pre-

WIRING BRICK AND Tile plants

WIRIN

Brick and tile manufacturing plants make extensive use of electric power in their production line. And these plants are important phases in the building materials construction industry. This is especially true for industrial construction since practically all modern industrial buildings are of brick and steel.

The introduction of special machinery has enabled modern brick and tile plants to increase the quality and quantity as well as uniformity of production. Electric motors are used principally to oper-

CHECK LIST FOR BRICK AND TILE PLANTS

Kilns

Manufacturing Motor Applications

Auger Brick Machines
Battery Charging Sets
Blowers
Brick Presses
Brick Represses
Bucket Elevators
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Cranes
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Dry Pans
Excavating Shovels

Fans, Ventilating

Hoists

Moulding Machine
Pug Mill
Pumps
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Sand Dryers
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HOLDENLINE CHAN'L-RUN

Ill winds that blow nobody good? No sir, the brisk March winds are Trade Winds for alert electrical contractors and the long, dark days ideal for the demonstration of indoor daylight with versatile HOLDENLINE CHAN'L-RUN fixtures.

NEW ITEMS? You'll See Them Soon!

They're being carefully pre-tested now. Yes, those dramatic new HOLDENLINE fixture designs are off the drawing boards, samples have been developednow the engineers are putting them through their paces-carefully proving their right to join the line of fluorescent fixtures that made HOLDENLINE a pioneer in engineered lighting.

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2. High lighting efficiency—
photometrically designed reflectors.

3. Quick and simple conversion to continuous run — with

mountings.

Ample wire freeway.

5. No dark areas between lamps on 21/2" centers with CS S-80.

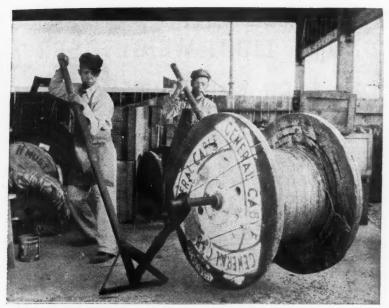


FIG. 1—When the levers have been forced clear down, raising the reel, lengths of smaller pipe are thrust into the reel ends of the pipe levers, so that the levers will not flip up and drop the reel.

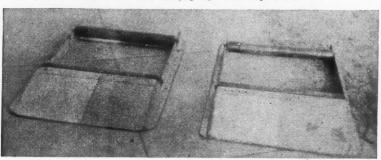


FIG. 2—By making the reel stand in two halves, flexibility is secured and the halves are easy to lift and carry around, not weighing over 25 pounds each.

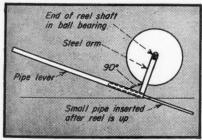


FIG. 3 — Lever length reduces man power required to handle reels.

venting the latter from flipping up and dropping the reel. This type is used for larger reels.

For small and medium sized reels, the second device, see Fig. 3, has its advantages. A pair of angle iron frames approximately 2 feet by 16 inches were welded and two rollers, with their bearings, from an old belt conveyor, inserted between the side members. A narrow steel-plate incline was welded to one of the end members of each half.

In use, the two frames are laid on the ground so that the rollers are end to end, and at a distance apart sufficient to accommodate the end disks of the reel when resting on the rollers. To accommodate reels of various diameters, holes were drilled in the side frame members, about 4 inches apart, to take the bearings of the rollers. For reel disks of smaller diameter, the roller centers are moved closer together.

The principle is similar to certain unit roller frames now on the market, fabricated in one piece. But by making the device in two halves, flexibility as to length or reel axis is secured, and also they are easier to handle, the weight of each half not exceeding 25 pounds.

BRAZED CAM FOLLOWERS

__INDUSTRIAL

A savings of 13 cents per part on standard cam followers was made possible through the adoption of a two-piece copper brazing assembly method at The Glenn L. Martin Company, Baltimore, Md. Prior to this time the cam fol-

lowers had been machined in one piece from solid steel bar stock.

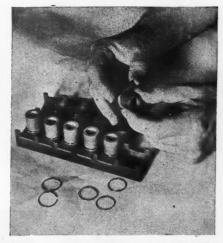
The assembled part consists of a rectangular flange with small tubular projections at each side from the center hole of the flange.

In the old method the followers were "sculptured" from round bar stock on a screw machine. The parts were roughed out, finished to the proper diameter and the center hole was drilled and reamed. Two small holes in the flange for attaching the part to its next assembly were then drilled and burred. Another operation was required to blank off both sides of the round flange to make it rectangular.

Using the brazing method, the cylindrical portion of the assembly is a piece of stock steel tubing, which is sized to the proper diameter for brazing and cut off in the screw machine. The rectangular flanged portion is blanked from strips of steel stock by a progressive die. The round hole in this rectangular piece through which the cylinder passes is blanked and sized to proper dimensions in the same operation. Proper dimensions are essential to ensure a satisfactory brazing fit.

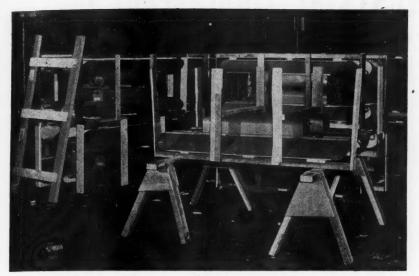
For brazing, the cylindrical portion is slipped into the hole in the flange after which the assembly is placed on a parts holder and the rings of copper brazing are placed on each assembly at the joint. The parts holder is loaded with the assemblies and placed in an electric brazing furnace. During the brazing process the copper ring melts and creeps into the joint by capillary attraction, resulting in a strong clean joint. After brazing, procedure to finish the parts is the same as in the prior method.

During tests the new type followers were found to have strength beyond any previous design requirements.



Rings of copper brazing material are slipped over the assemblies on the parts holder. After the assemblies are in the furnace, the copper melts and is drawn into the joint by capillary attraction.





Storage of RF fluorescent units is made safe and easy by simple crating illustrated here. One crate holds four fixtures, complete with lamps. Crates can be stacked on top of each other without damage to fixture or lamp. Method used by Buick Motor Division of General Motors Corporation during remodeling of one of their Flint, Michigan, plant buildings.

PAYOUT REEL FOR SMALL CONDUCTORS

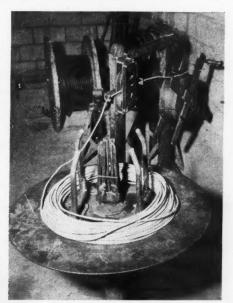
SHOP

Cutting specified lengths of small building wire for branch circuits, switch legs, motor control circuits, or other installation needs—whether it be in the shop or on the job site—is simplified by a turntable type of payout reel designed by the Electric Service Company of Ann Arbor, Mich. Adjustable "fingers" on the turntable accommodate various coils of wire ranging from six-inch to 14½-inch inside diameter.

The complete assembly is made of steel. Four angle-iron feet, each 17-



Wire payout turntable, rotating on conduit pedestal, has four adjustable fingers to accommodate coils with various inside diameters. Knurled hand nuts on underside of turntable rigidly position fingers.



Closeup view of payout turntable showing a partial coil of building wire being unwound through a measuring device. Note positioning of fingers and center attachment for smaller coils of wire.

inches long, are welded to the bottom of a 3-inch conduit pedestal to form the supporting framework. Resting on the pedestal at table-top height (30 inches) is a 24-inch diameter, $\frac{1}{4}$ -inch sheet steel turntable which is mounted, by floor flange, to an 18-inch length of $1\frac{1}{2}$ -inch bronze shafting. The shaft telescopes into the conduit pedestal and is adjusted by two set screws at the base, providing rigid support while permitting the turntable to rotate freely. Sufficient friction is present to act as a brake on the coil of wire being unwound.

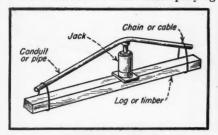
Four adjustable "fingers," each 9-

inches high with a 4-inch arm at the base, pivot on a threaded bolt welded to the inner end of the arm and extending through holes drilled in the turntable. Made of bolt stock, these fingers swing inward or outward to accommodate coil diameters from six to 14½ inches. Knurled hand nuts on the underside of the turntable lock the fingers into the desired position. A center attachment is added for coils of fixture wire and others of smaller inside diameter.

The complete unit takes very little floor space and can be used with or without a wire-measuring device. With this simple, convenient piece of equipment, one man can measure and cut any number of conductor lengths without fear of the wire kinking or snagging during the operation.

MAKESHIFT BENDER

An unforeseen offset or bend required in a large conduit occasionally holds up a remote job where there is no heavy pipe bender readily available. The method shown in the accompanying



Jack and timber makes emergency pipe bender in the field.

sketch has proved a useful solution on several occasions according to M. L. Monson of Fosston, Minnesota.

The conduit is held at the ends to a heavy timber by chains or heavy cable. A jack provides the bending thrust. Tightening the chains and blocking the jack gives the necessary proportions to the bend.



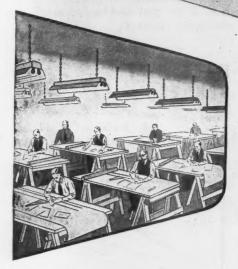
Over on the Montana line is Beach, North Dakota, home of Raisler Electric, enterprising rural electrical contractors. Members of the Raisler, organization above are (L to R): Frank Kukowski, George Seeley and Stanley Raisler.

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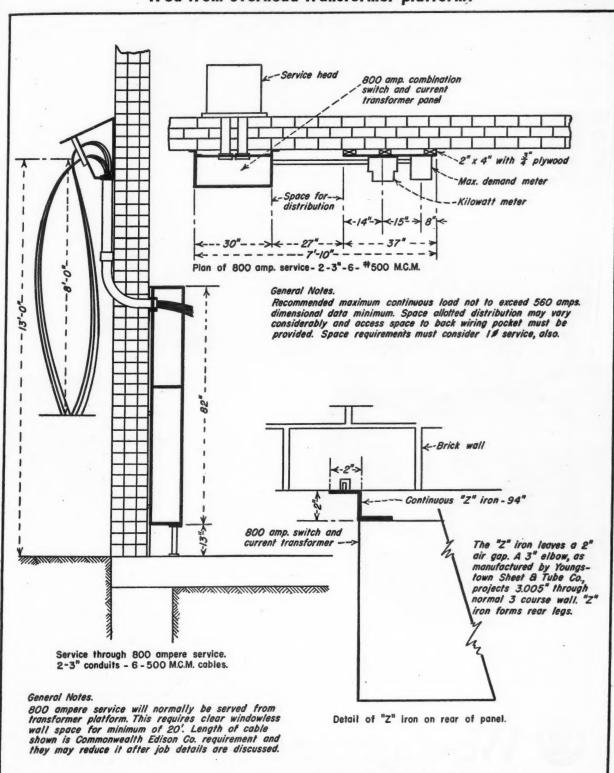
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XP-2

Engineering Detail and Cost Data

800 Ampere Three-Phase Service

(Fed from overhead transformer platform)





Luminaires are aluminum High Bay reflectors with wide-spread distribution. To clear the cranes, they are mounted high above the assembly area, cor-rectly spaced for uniform light distribution. 20 to 30 foot-candles are recommended for general assembly areas of this nature.



GOOD lighting equipment alone can't produce good lighting. Back of the equipment itself, there must be accessible—to architect, contractor and user alike—practical knowledge of the many recent advances made in athlication of lighting recent advances made in application of lighting equipment. You get BOTH with Westinghouse.

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porate the newest in design features, but where any out-of-the-ordinary application problems are involved, the breadth of Westinghouse experience is also available to insure its most effective use.

Westinghouse lighting equipment is available in a complete range of types and ratings for every commercial, industrial and floodlighting use. Write today for Bulletin No. B-3568-which describes the Westinghouse "Millite", a particularly versatile luminaire for heavy industrial use. And for help in selecting and applying the best equipment for your needs, call your Westinghouse distributor, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.



For critical seeing tasks, Westinghouse Focalaires supplement the general lighting and provide up to 300 foot-candles on the working surface.



WESTINGHOUSE ELECTRIC SUPPLY CO. OFFICES AND INDEPENDENT DISTRIBUTORS

Engineering Detail and Cost Data—Continued

Material Item	Quan.	0)		Co	st	1	Jnit		Labo	or H
3" Galvanized Conduit. 3" Elbows Galv. 3" Couplings Galv. 3" Service Head. 3" Fibre Bushings. 3" Locknuts. 800 Amp. 3 Pole Switch and C/T. 400 Amp. Fuses 1 Time. 3%" x 11½" Bolts. 1/4-20 Expansion Shields. 1/4-20 Expansion Shields. 1/4-20 x 2½" Bolts. 1/4-20 Large Washers. 11½" Floor Flanges. 11½" x 11½" Pipe Nipples. 500 M. C. M. Type R Cable. 11¼" Thinwall Connectors. 11¼" Thinwall Couplings. String Solder. Solder Paste (Can). 11¼" Thinwall Elbow. 11½" Thinwall Elbow. 11½" Thinwall Conduit. 11¼" Thinwall Elbow. 11¼" Thinwall Fitting. 1/4" Red And White Wire—Coded. 1/4 Red And White Wire—Coded. 1/4 Red Wire. 1/4 Green Wire. 1/4 Hole Porcelain Cover. 1/4 Well Wire. 1/4 Hole Porcelain Cover. 1/4 Well Well Well Well Well Well Well Wel	6 2 2 1 4 8 1 6 4 4 5 6 9 9 4 2 0 2 2 1 1 6 1 1 2 2 0 0 2 1 1 1 1 1 1 1 3 9 4 1 1	51 2 1 1 3 2 1 422 11 8 8 8 8 8 2	94 81 46 45 17 37 08 55 55 05 51 17 08 37 37 45 10 47 29 06 78 78 61 61 61 61 75 04 01 02	C Ea. Ea. Ea. Ea. Ea. Ea. Ea. Ea. Gr. Ea. Ea. Ea. Ea. Ea. Ea. Ea. Ea. Ea. Ea	3 5 5 18 5 5 1 208 8 8 42 42 2	12 92 15 80 36 00 22 32 10 75 02 16 12 84 34 21 74 45 10 69 29 06 11 11 43 43 17 75 04 01 02 33 14 62 54 03 03 03 03 03 03 03 04 05 05 05 05 05 05 05 05 05 05 05 05 05	13 1 1 5 6 6 6 6 6 6 6 6 6 6 6 6			4 6 9	8 9
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					\$312	04				45	94
Special Labor Items	٠						Un	it		Labor	Hr.
2-3" Terminals					• • • • • • •	• • • • •	23	75 90 76 10 56 25 08	Ea. Ea. M Ea. Ea.	3 1 4 2 3 1 3	50 80 56 31 36 50 76 00

*Oil—Blades—Short Ends Conduit and Cable No Ground Included.

Note: The above is typical of reference data sheets that can be developed for typical service and electrical equipment installations. The arrangement and cable overhang comply with Commonwealth Edison Co., specifications in Chicago. Check your local utility for their requirements when developing your own data file.

Data from L. W. Witz, Continental Electrical Construction Co., Chicago, Illinois

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Good Lighting is important in stock rooms, Inipping and receiving departments, repair shops, warehouses, garages and all other store service areas. Adequate Lighting with Benjamin Lighting Units will reduce errors and accidents and increase the amount of work turned out. Benjamin units, with their life-time porcelain enamel reflectors and built-like-a-battleship construction, assure you of low cost, high efficiency and maximum durability . . . as well as quicker, easier cleaning and maintenance. Incandescent

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for general and local fluorescent lighting. A closed end porcelaig enamel unit, efficient, trouble-free, built for a life-time of service Available in two- and three-lamp units for 40 watt (48") lamps.



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for general and local fluorescent lighting. Same as Stream-Flo except open-end type. All Benjamin Fluorescent units comply fully with Underwriters' Laboratories requirements, provisions of National Electrical Code and conform to all applicable RLM Standard specifications as to illumination standards and uniform quality.

CONTRACTORS ... This Advertisement

addressed to Chain Store Operators, Store Owners, etc., is reproduced here to call to your attention the many Benjamin units now available which are designed to meet many Store Lighting Requirements.

For complete information about this and other Benjamin equipment, consult your Benjamin Catalog, Electrical Trade Directory or the Electrical Wholesaler from whom you purchase Benjamin equipment. BENJAMIN ELECTRIC MFG. CO., Dept. H, Des Plaines, Illinois.



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Ellipto-Lite Floodlight New, low-priced wide angle open type, with elliptical shape porcelain enamel reflectors.



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Types to meet all sign lighting conditions.

Vapolets

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High Frequency Heating—IV

Wartime research and production techniques have considerably broadened the field for high frequency dielectric heating of non-conducting materials. This final article of the series outlines the theory, application and maintenance of this electronic heat source.

NERYONE at some time or other has encountered a problem involving the difficulty of uniformly heating a mass of non-metallic material. The housewife must roast a large piece of meat many hours because it requires that length of time for the heat to penetrate to the innermost sections. The man with a house in the country rakes leaves and piles them in the sun to dry. When ready to burn them, he often finds that the sun's heat has not penetrated the inner portions and the leaves there are too damp.

Identical problems, though far more important and far reaching in latitude, are found in industry. Non-metallic materials are inherently electrical nonconductors. Poor electric conductors are poor thermal conductors. The basic philosophy of conventional heating methods is to conduct thermal energy into the mass through its surface; the source of heat being either radiant energy or a surrounding atmosphere at elevated temperature. But whether radiation or conduction is used, the energy must enter through the surface and slowly soak into the material. Hence the industrial engineer has always looked forward to a method whereby he could heat such materials as wood, plastic, rubber and similar non-metallic, and usually organic, substances rapidly and uniformly.

For many years it has been common practice in medicine to use high frequency electrical energy to selectively heat portions of the human body and so derive the therapeutic value of the

By J. Wesley Cable

Director of Research and Development Induction Heating Corporation New York, N. Y.

"localized fever" thus induced. Industry, in its search for this rapid uniform heating, drew a parallel between its problem and that of the doctors. As a result, today we have industrial high frequency dielectric heating.

Although the fundamental principles of this process were described earlier in this series, it is well to again review them at this time.

Theory of Dielectric Heating

High frequency dielectric heating is accomplished by a phenomenon known as dielectric hysteresis. In common language, this means that when a molecule of a certain material is distorted by an electric field, it does not release all the energy that is induced in it and this small percentage which remains shows up as the heat energy and manifests itself as a temperature rise in the material. There are many theoretical explanations but the simplest to understand is to liken the molecule to a sponge rubber ball that is being alternately squeezed and released many millions of times per second. The friction of the molecules, one against the other, within the rubber ball would soon cause it to heat up. The molecules applied to the high frequency field react similarly.

The elemental form of equipment for producing a heat-releasing high fre-

quency field is an oscillator, which produces electrical energy of considerable potential; and a pair of electrodes, whose shape doesn't matter, flat and parallel to each other but spaced at some given distance (see Fig. 1). Between these two flat plates are many lines of electrostatic force. When material of poor electrical conductivity is placed between these plates, the molecules of the material vibrate or deform as the polarity in the field changes with the frequency. The degree of vibration or deformation is a function of the voltage and also a value which we term "loss factor." This loss factor is obtained by multiplying the power factor of the material by its dielectric constant. Consequently, the total power per unit mass of material is dependent upon the frequency of the dielectric field, the square of the voltage across the unit mass, the dielectric constant of material, and the power factor.

When the unit mass becomes a section of fixed dimensions, then the power is determined by the following formula:

Power = 1.41 E² fF₁
$$\frac{A}{t} \times 10^{-13}$$
 watts.

Where: E = the voltage impressed on the material; f = f frequency in cycles per second; $F_1 = the$ loss factor (power factor \times dielectric constant); A = a rea of material between the electrodes in sq. in.; t = the thickness of the material in inches.

High frequency dielectire heating should be considered for any industrial heating process where the material is a poor electrical conductor, a poor thermal

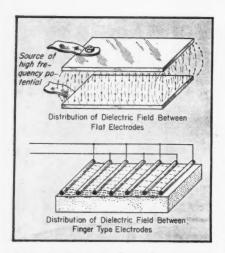


FIG. 1—Typical electrode arrangements for dielectric heating showing the distribution of the dielectric field between electrodes of various shapes.

conductor (these two properties go hand in hand) and where uniformity of heating is essential. The reason for considering dielectric heating under such conditions is that here it can show itself to best advantage. First of all, it is rapid with extremely high rates of energy transfer per unit weight. An example of such would be a block of wood 2 in. by 4 in. by 8 in. absorbing 275 B.t.u.'s per minute or approximately 5 kilowatts. Dielectric heating provides a uniformity of heating that is impossible to obtain by any other means. Since each unit mass of material throughout its cross section absorbs the same amount of energy, it is obvious that the temperature rise throughout the mass is uniform. This is quite different from the results obtained through conventional methods which inherently produce a steep temperature gradient from the outer surface to the inside due to the heat flow in that direction. In dielectric heating, the heat flow may be opposite since the outer surfaces of the material radiate their energy and consequently the innermost portions undergo a greater temperature rise than the surface. This, however, can be controlled by regulating the energy input per unit mass or reducing the radiation by the

utilization of radiant energy or hot atmosphere in conjunction with dielectric heating.

Plastic Modeling

Probably the most publicized and widespread use of dielectric heating has been in the plastics field where great improvement in production techniques and resultant product have been accomplished. Although the equipment has found application with both thermosetting and thermoplastic materials, it has played a far more important role with thermosetting plastics (Fig. 2). This is natural since thermosetting materials undergo polymerization at a given temperature, which must be attained during the curing process. As an example, the transfer molding process for thermosetting materials can be cited. The conventional method of molding such material is to compress the bulk material consisting of the basic plastic and the filler into "preforms" approximately in size the shape of the pot on the transfer molding press. To shorten the time required for the molding operation, it is necessary to preheat the preform to a temperature slightly below the curing



FIG. 2—Dielectric heated preform is being placed in a transfer molding press. Note the plasticity of the preformed material.

temperature in order to compensate for the poor thermal conductivity of the material which limits the rate of heat transfer from the steamheated mold. This low thermal conductivity also makes the conventional preheating oven very slow, often giving non-uniform results due to inability to control the small oven temperatures. Since the heat is conducted from the surface to the center, a high temperature gradient exists across the piece, sometimes causing surface curing and resultant crustation, which makes it impossible to mold such preforms.

Dielectric heating proved itself an ideal method for heating plastic preforms since they were heated rapidly and uniformly (See Fig. 3 and 4). Because of the precise temperature control, the preforms can be brought to within a few degrees of the polymerization temperature, thus making the material far more fluid and greatly improving its molding qualities. Press tonnage can be lessened for a given weight of material. More intricate molds can be used because of the flow characteristics developed at the higher temperatures and more rapid curing can be obtained as a result of less heat being supplied by conduction from the mold proper. All these things pointed to improved quality and greater impact resistance in the molded item. A comparison of typical results obtained by conventional and high frequency heating for various materials is shown in the following table:

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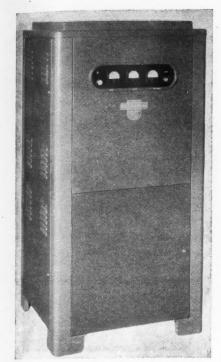
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Bonding of Plastics

High frequency bonding by fusion of thermoplastic materials has also been an important contribution of dielectric heating. Vinylite sheets used in the fabrication of waterproof bags, raincoats, and similar items have been joined at the seams by this method, using in effect a sewing machine with the needle replaced by a small pair of electrodes. The material coming between these electrodes is placed under pressure and a high frequency field applied which causes the material under pressure to be

*						
COMPARATIVE	VALUES	FOR	OVEN	AND	HIGH-FREQUENCY	HEATING

Material	No. of Preforms	Size of Preform in.	Total Weight of Preforms oz.°	Preheat Time Oven H.F. sec.	Mold Closing Oven H.F. sec.	Oven H.F.
Bakelite 16089	1	3/4x1-3/4x12	7	600 45	25 3	180 90
	6	3/4x3 x 4	24	900 55	40 10	300 120
	2	1 x1-3/4x12	20	900 70	40 12	900 480
	2	1 x1-3/4x12	20	900 75	a 23	900 480



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FIG. 3—Dielectric H. F. generator unit with a $3\frac{1}{2}$ kw. output at 20 megacycles. Units like this are used for the setting of phenolic resin.

heated to the fusion temperature. In some cases, the electrodes are in the shape of bars ranging from one inch to several inches in length which "weld" a corresponding length of the seam in one application of energy. The pressure is then released and the material moved through until a new section comes between the electrodes. Such a process lends itself to very rapid production rates and extremely uniform and homogeneous bonds.

There are many other products which combine the use of plastics with other materials in the fabrication of various items. Laminates made up of thin sheets of cloth, fibre, wood and other similar materials have these sheets bonded together with thermosetting plastics and here again dielectric heating fits ably into the picture. Since pressure is always required in any laminating process, it is often possible to combine the high frequency electrodes with the platens of the press, thus heating the stacked materials while it is under pressure and setting the bonding agent.

The manufacture of plywood is a typical example of such a fabrication process. The conventional method was to stack the thin veneers of wood with the plastic glue in between. When these sheets had been piled up to a thickness of four or five feet, they were placed in a heavy steamheated platen press and allowed to

remain in the compressed position until the heat from the platens had penetrated the mass and set the thermosetting glue. Such a process is inherently slow and frequently required from 48 to 72 hours for curing to take place. By the insertion of a thin copper electrode in the middle of the stack and the application of a high frequency electrical potential between the center electrode and the grounded press, the plywood could be heated uniformly throughout at a very rapid rate. The curing time was cut to a matter of three or four hours. The resultant economics of dielectric heating are so pronounced that the method was immediately adopted by the plywood industry. The necessary presses represent large investments, and where the time for producing a given amount of plywood is substantially reduced, the manufacturer cannot afford to operate without dielectric heating.

The fabrication of a material called "Compreg" has been speeded up considerably by the use of high frequency dielectric heating equipment. This material consists of wood blocks which have been impregnated throughout with a thermosetting plastic, then compressed under high unit pressures to form a high density mass having very good physical characteristics. Here again the matter of heating the material was similar to the plywood applications and superior quality material was produced.

Another application of high frequency heating to a similar process has been in the joining of wood sections through

the use of thermosetting plastic glues. The furniture field has found this method extremely advantageous in the formation of mortise and tenon joints for furniture construction. Also the fabrication of wooden aircraft spars was accomplished by this means. The process in such cases is not entirely dielectric heating but includes some high frequency resistance heating, since there is considerable current concentration down the glue line of the joint. The electrodes are positioned so, they are in direct contact with the glue at both ends of the joint. Before the material is set, its electrical conductivity is high at the frequencies employed and therefore, both resistance heating and dielectric heating take place, The resultant products obtained by such joining methods show a glued joint stronger than the base wood itself. The fact that such joining can be accomplished in a matter of seconds makes the process well adapted to the production line.

Rubber Vulcanization

The rubber industry is perhaps one of the largest potential users of high frequency heating for the vulcanization of rubber. Here the process is similar to that of thermosetting plastic material, since a certain temperature must be held for a given time to allow vulcanization, or curing, to take place. The greatest impedance to the use of dielectric heating in the rubber industry thus far has been the present philosophy of mold

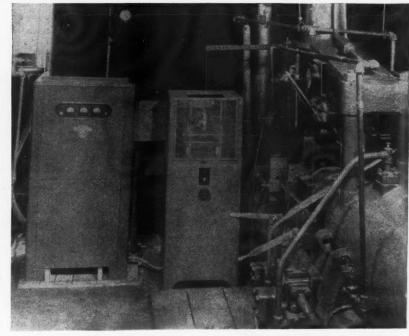


FIG. 4—Dielectric equipment is installed adjacent to a plastic molding press. Units are a dielectric generator and a preform preheating cabinet.

design; the molds being made up of heavy metal sections heated by steam passages. Since these molds are closed before the vulcanization period, it is very difficult to adapt them to high frequency heating because a high voltage electrical potential must be applied across the adjacent mold sections. Extensive research work is now being done on the use of non-conducting mold materials which will withstand the pressures involved so that the electrostatic field can be applied across the entire mold, thus heating both it and the enclosed uncured rubber stock to the vulcanizing temperature. Undoubtedly the rubber industry will develop plasticizers and accelerators which will fit into the dielectric heating process to allow much more rapid vulcanization at low temperatures. There are at present many rubber molders using dielectric heating for preheating rubber pellets in the same manner as the heating of plastic preforms. This has resulted in a greatly reduced curing time within the mold because of the use of preheated stock.

Food Processing

A great deal has been written concerning the use of high frequency dielectric heating for food products. While it is doubtful whether or not the housewife will ever replace her kitchen range with the dielectric heater and thus be able to cook foods in a matter of seconds instead of hours, it seems quite probable that dielectric heating will play an important part in the commercial end of the food products business. One specific application which shows great promise is the deinfestation of grain and cereal products, following packaging, by the application of dielectric heating. The presence of eggs and larvae of weevils in cereal products is a constant problem to the manufacturer and it has been practically impossible to eliminate them entirely. Since the egg or larvae had different physical characteristics than the cereal, the former is heated much more rapidly when the packaged material is subjected to a high frequency dielectric field. The heating induced within the egg or larvae immediately destroys it without damaging the cereal and thus makes the product safe from contamination in storage.

· A similar problem is the killing of the hoof and mouth disease virus in contaminated meat products. Extensive research programs carried on by various universities have shown that the hoof and mouth virus can be rendered harmless by exposing it to a temperature of approximately 160° F for a period of two minutes. To accomplish this by conventional heating is a slow, time consuming, process and does not lend itself to precise control. Consequently the regulations covering contaminated meat require it to be precooked after canning at a temperature of 400° F for three hours. The resultant mass of meat has lost all its eye appeal and can be used only for low-grade consumption.

Choice cuts of contaminated meats can be passed through electrodes which rapidly bring its temperature uniformly to 160° F and upon holding it there for the required two minutes, does not cause the meat to lose any of its original appearance or tastiness. Such processing may render available to the public vast supplies of South American beef which heretofore were restricted because of the widespread hoof and mouth conditions in these countries.

Another application of high frequency

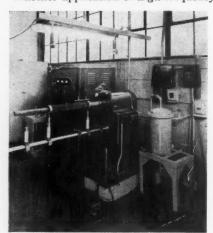


FIG. 5—Impregnated paper filter tubing is being dielectrically heated. Note the cylindrical electrodes—high potential on outside; grounded mandrel inside the tube.

heating to the food field is in the rapid thawing of frozen food to make it ready for consumption. While again it is not economically feasible to take a small household size package of frozen vegetables and quickly thaw it out in a matter of two or three seconds by electronic heating, it is entirely within the realm of possibility to apply this heating to bulk lots such as barrels of frozen food used commercially. Such large masses require many hours under conventional heating methods and this slow heating often encourages spoilage whereas rapid heating immediately makes the product available to the user.

As pointed out previously, dielectric heating can be applied wherever heating of poor thermal conductors is required. Liquids such as drug solutions and pharmaceuticals, fruit juices and essential oils can be evaporated by dielectric heating, especially with a newly developed spiral-type electrode.

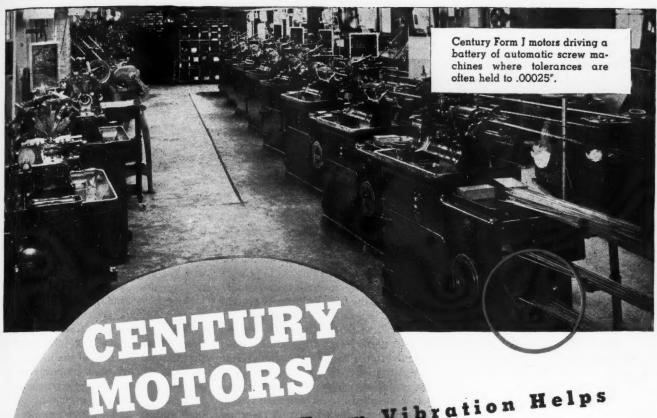
Other Applications

The drying of ink on paper as it leaves a printing press has been considered. Foundry cores impregnated with thermosetting material can be heated in a matter of seconds where it formerly took hours. Synthetic yarns such as Nylon and Rayon can be annealed and dried in bulk lots by dielectric heating. Photographic papers and emulsions on film lend themselves to drying by this method. The imaginative mind can go on for hours bringing out numerous applications. The surface has only been scratched as far as putting this equipment into actual production and the close cooperation between the manufacturers of such equipment and the industrial user will undoubtedly bring many new uses to the fore.

Choice of Units

It is natural to wonder what type of equipment is best suited for each of the applications listed heretofore. Fundamentally all the equipment on the market available for dielectric heating performs the same function and the promotion of one manufacturer's over another's is a salesman's job, rather than that of a technician. The units are primarily high voltage, high frequency oscillators employing electronic tubes to obtain output frequencies ranging from one million to two hundred million cycles per second. The choice of frequency is relatively unimportant for some applications and extremely critical in others. This depends upon the loss factor of the material which may vary widely with the frequency. Some types of rubber, for instance, may have their loss factors multiplied by ten when the frequency is changed from three megacycles to ten megacycles. Obviously the frequency chosen should be that which gives the greatest possible loss factor and thus permits the best utilization of the available oscillator capacity. Other materials which contain a large percentage of moisture do not have this change of loss factor with frequency and, in these cases, frequency is unimportant. Little if any generalization can be made along these lines and it is suggested that those interested take their particular heating problem to a reputable manufacturer for advice as to the choice of frequency.

There are certain elements in the equipment that should be considered



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when the choice is made. Of prime importance is the use of a coaxial line between the source of energy and applicator electrodes. Such a line greatly improves the utilization of the equipment and practically removes the danger of personal injury by operators coming in contact with unshielded high voltage conductors. The use of a tuning network at the applicator electrodes is also important since this lends itself toward extreme flexibility as to the material that can be heated.

Adjust for Heat Cycle

Most dielectric heating units should have, built into the equipment, an accurate timer which controls the heating cycle after it is determined by experimentation. In this way, duplication of results must obtain, for a well designed unit holds its frequency characteristics constant and the only variable in the energy equation is time. In the initial setting up of an application, the material is placed between electrodes which approximate the shape of the material itself, extending radially to compensate for any fringe effect of the field. The electrodes may be in actual contact with the material if the surfaces permit and the thickness of the material is sufficiently uniform to allow even heating. If the thickness is irregular or the electrical characteristics non-uniform, it is advisable to have an air space between the top electrode and the material which more or less acts as buffer in producing uniform heating. After the initial adjustment of the electrodes, the voltage of the oscillator is raised until the flashover, or puncture voltage of the material, is approached. The usual method consists of bringing the voltage up until flashover actually occurs and then reducing the voltage to a safe value. Since the heating is a function of the square of the voltage, it is advisable to maintain this voltage at as high a value as possible but still not high enough to present the flashover hazard.

The unit is now energized for sufficient time to bring the material to the predetermined temperature which can be measured by use of spirit thermometers placed with their bulbs in the center of the mass or by thermocouples imbedded in the material. Caution should be taken in this latter method of measurement, however, since the thermocouple will assume a potential somewhere between the electrode potentials and may present a source of personal injury if precautions are not taken. The time required to raise the temperature of the mate-

rial to the desired value is noted by means of a stop watch or special timing device and the corresponding value is set on the timer in the machine. Subsequent pieces of material placed between the electrodes will then come up to the desired temperature automatically and the oscillator will be shut off by the timer at the preset value thus insuring duplication of heating cycle.

High frequency dielectric heating may employ either air-cooled or watercooled oscillator tubes and the controlling factor is usually the size of the equipment involved. Small units, say up to 2 kw. output, employ air-cooled tubes, some of which require forced air circulated over their radiators to provide adequate heat dissipation. Such installations entail the use of filters to prevent dust from collecting on the plates of the radiators and thus reduce their thermal transfer coefficients. Water-cooled tubes are used in the larger installations. Here the plate of the tube is contained in a water jacket which circulates cooling water supplied by an external source. Although such equipment requires water connections, it is usually considered more dependable for industrial operation since it is not subject to shut down as a result of dust collection.

Protective Devices

Certain safety features are involved in these water-cooled units. Any unit employing water cooled tubes should include in its protective circuit a thermal trip which de-energizes the unit if the cooling water goes above a predetermined temperature. With this thermal trip, a flow switch is essential since the cooling characteristics of the water jacket and tube plate depends not only upon the temperature of the cooling water but the flow in gallons per minute. Therefore, the flow switch should be calibrated directly in gallons per minute. A pressure switch is also an essential protective device since it complements the other control units to insure adequate water cooling. Since high power oscillator tubes have a certain amount of thermal storage in their heavy filaments, it is necessary to cool the plates of the tubes for a few minutes after the tubes are de-energized. For this reason, it is well to have a device which will permit flow of the cooling water for a few minutes, even though the main supply valve has been shut off.

Overload protection in the plate circuit of the oscillator is mandatory since it is often possible to damage the oscillator and rectifier tubes if they are sub-

jected to overload conditions for any length of time. Since the overload characteristics of any piece of electrical equipment is a function of its thermal storage—and high frequency vacuum tubes have very little because of their low mass—their protection against overload is doubly important.

Safety Measures

There are two sources of personal injury hazard in high frequency dielectric heating oscillators; one in which fatality from electric shock can occur and the other from which severe burns can be obtained. The former is true with the high voltage power supply section of the oscillator where voltages ranging from 5,000 to 15,000 volts, both a-c and d-c, are present.

It is essential that all access means to this section be carefully interlocked so that the unit will trip off the line and deenergize all component parts if entrance is attempted. It is also essential to have a simultaneous grounding of the high voltage d-c circuit when any door of the cabinet is opened.

The high voltage, high frequency leads must be enclosed in raceways wherever they may be a hazard to human life.

Although it is impossible to be electrocuted by this high frequency energy, it will cause severe burns, deep seated and difficult to heal. Therefore, it is advisable, as previously stated, to use coaxial cable to transmit the high frequency energy from the generator to the point of application. Wherever possible, it is advisable to shield the applicator electrodes and control network to prevent the operator from coming in contact with the high frequency circuit. The door to such shielding should also be interlocked to provide adequate protection for the operator.

Little Maintenance Required

As far as maintenance of dielectric heating equipment is concerned, it can be considered practically negligible. The only requisite is an occasional "blowdown" of the equipment with an air hose to remove any accumulated dust since, as every electrical man knows, dust is an enemy of high voltage equipment. This is true not only of the oscillator proper but also the applicator electrodes. If the material being heated emits vapors which condense upon the electrodes, it may be necessary to remove this condensation to prevent its accumulation. In extreme cases, it may

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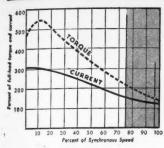


Figure 1

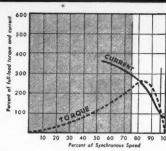


Figure 2

As these graphs show, Wagner repulsion-start induction motors combine the most desirable operating characteristics of the repulsion motor and the induction motor. Figure 1 shows the speed-torque-current characteristics of a repulsion motor while Figure 2 is for an induction motor. Note that when the unshaded portions of these two graphs are combined, the most desirable characteristics of both are retained in the new graph, Figure 3, which shows the performance curves of a Wagner repulsion-start induction motor.

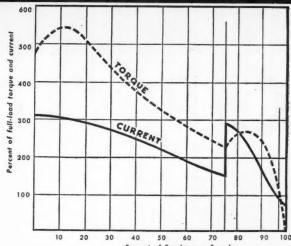


Figure 3

These benefits to you, as a user of Wagner repulsion-start induction motors, result from this happy combination of the best features of two types of motors:

Desirable Features of Repulsion Motors

- High starting-torque enables them to start high-inertia loads and accelerate them smoothly.
- Lowest starting-current of any type of single-phase motor, therefore least likely to cause light flicker.

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Desirable Features of Induction Motors

- 3. Fairly constant and high operating speed at all operating loads.
- 4. Fairly flat efficiency curve over wide operating range.

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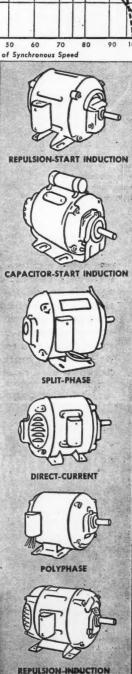
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TRI-STATE SUPPLY CORPORATION LOS ANGELES 13, CAL. • SAN FRANCISCO 7, CAL. • SEATTLE 4, WASH. be advisable to use a small fan blowing across the electrodes to disperse the vapor into the atmosphere.

Tube replacements do not constitute a major maintenance item, since the usual life of water-cooled oscillator tubes runs from five to six thousand operating hours, while the rectifiers average as high as 10,000 hours of service life.

Radio Interference

As a final thought, it may be well to discuss briefly the precautions and limitations which are placed upon dielectric heating equipment by its inherent ability to interfere with radio reception and other communication devices operated by means of high frequency radiation. However, it is impossible to accomplish this completely.

With proper design-and in cases where the applicator electrodes can be shielded-it is believed that the radiation from any industrial unit can be kept to a value which will not present any appreciable interference as far as communications are concerned. In large installations where means of putting the work in the electrodes and removing it becomes a large problem, as in the plywood field, it may be necessary to employ shielding around the entire unit to prevent radiation of a magnitude sufficient to cause interference to communication services.

The Federal Communications Commission as a result of its recent hearings, at which the writer had an opportunity to present the facts of high frequency heating, have allocated three channels, 13.66mc, 27.32mc and 40.98mc, where units can be operated without limitation of radiation.

The various manufacturers of high frequency dielectric heating equipment, along with other national technical organizations, are now in the course of preparing recommendations to the Federal Communications Commission as to what they consider "good engineering practice" in allocable radiation tolerances.

All of the foregoing indicates that high frequency dielectric heating is in its infancy. Although it may appear that considerable work is required to determine whether or not a particular problem can be solved by dielectric heating, much has already been done in the laboratory and data is available to assist in this direction. Dielectric heating is rapidly assuming its wellearned place alongside of induction heating as a valuable electronic tool and will become accepted productionwise by the industrial engineer.



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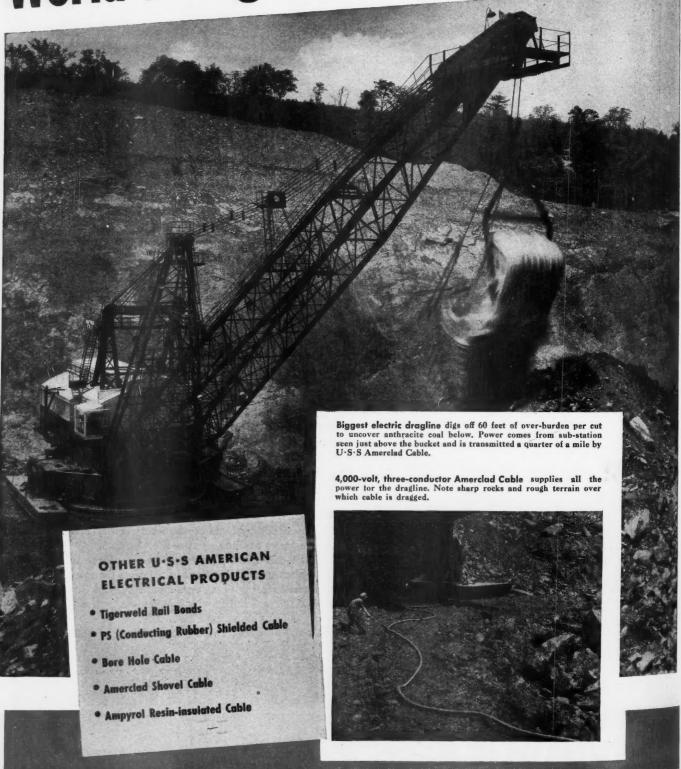
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200	.9	2.84	7.10	14.20	28.4	71.0	142	284
	.3	1.89	4.73	9.46	18.9	47.3	94.6	189
	.4	1.42	3.55	7.10	14.2	35.5	71.0	149
	.5	1.1	2.8	5.7	11.1	28	57	110
225	.9	2.52	6.30	12.60	25.2	63.0	126	259
	.3	1.68	4.20	8.40	16.8	42.0	84.0	168
	.4	1.26	3.15	6.30	12.6	31.5	63.0	126
	.5	1.01	2.52	5.05	10.1	25.2	50.5	101
250	.9	2.27	5.68	11.36	22.7	56.8	113.6	227
	.3	1.52	3.80	7.60	15.2	38.0	76.0	159
	.4	1.14	2.85	5.70	11.4	28.5	57.0	114
	.5	.91	2.28	4.56	9.1	22.8	45.6	91
275	.2	2.07	5.17	10.34	20.7	51.7	103.4	207
	.3	1.38	3.45	6.90	13.8	34.5	69.0	138
	.4	1.03	2.58	5.16	10.3	25.8	51.6	103
	.5	.83	2.03	4.06	8.3	20.3	41.5	83
300	.9	1.89	4.73	9.46	18.9	47.3	94.6	189
	.3	1.26	3.15	6.30	12.6	31.5	63.0	120
	.4	0.95	2.38	4.76	9.5	23.8	47.6	95
	.5	0.75	1.88	3.76	7.5	18.8	37.6	7
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	.4	.57	1.42	2.85	5.7	14.2	28.4	57
	.5	.45	1.14	2.28	4.6	11.4	22.8	45
1000	.2	.57	1.42	2.84	5.7	14.2	28.4	57
	.3	.38	.95	1.90	3.8	9.5	18.9	38
	.4	.28	.71	1.42	2.8	7.1	14.2	28
	.5	.23	.57	1.14	2.3	5.7	11.4	23
1500	.2	.38	.95	1.89	3.8	9.5	18.9	38
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2000	.2	.29	.71	1.42	2.8	7.1	14.2	19
	.3	.19	.47	.95	1.9	4.7	9.5	14
	.4	.14	.36	.71	1.4	3.6	7.1	11
	.5	.11	.28	.57	1.1	2.8	5.7	11

Data compiled by Industrial Electronics Division, Westinghouse Electric Corp., Baltimore, Md.

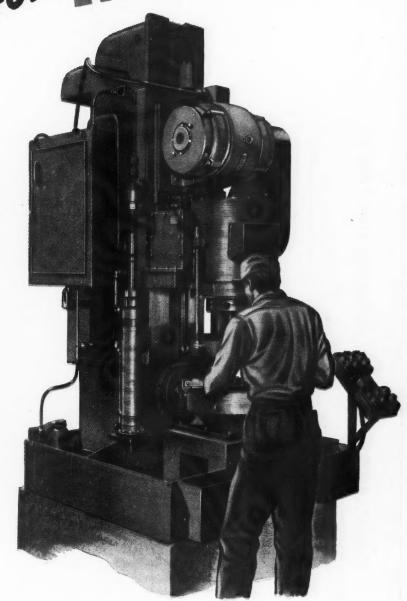
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Magnetos • Stokers • Railroad Motor
Cars and Standpipes • Farm Equipment

COMPARISON CHART OF WELDING ELECTRODES

	BARE	DUSTED		I	EAVILY COA	HEAVILY COATED TYPES- (Mild Steel)	(Mild Steel)		ALL	ALLOY ELECTRODES	SES	8	SPECIAL TYPES	
APPLICATION OF ELECTRODE	BARE ROD WELDING	BARE ROD WELDING	POSTION	A.C.	GENERAL PURPOSE WELDING AND POOR HTUP	A.C. OR D.C. WELDING	HORIZONTAL FILLET AND DOWNHAND WELDING	DOWNHAND	POSITION WELDING OF ALLOY STEELS	HORIZONTAL FILLETS AND BOWNHAND WELDING 70,000 P.S.I. STEELS	DOWNHAND WELDING OF 70,000 P.S.I. STEELS	MACHINEABLE CAST IRON WELD DEPOSITS	MACHINEABLE CAST IRON WELD DEPOSITS	POSTTION WELDING POR SLIGHT RESISTANCE TO ABRASSON
A. W. S. CLASS NO.	E-4510	E-4511	E-6010	E-6011	E-6012	E-6013	E-6020	E-6030	E-7010	E-7020	E-7030			
AIR REDUCTION	7	63	78E 79E	230	187	90 or 90A	81 or 83	83	63	9.4	76	55 95	77	46
ALLIED WELDCRAFT	Arc Craft B		55 55W	77 77W	70 70W	W77	09		Arc Craft Moly	70				
ALLIS-CHALMERS			E-6010	* E-6011	E-6012	E-6013	E-6020	E-6030	E-7010	E-7020	E-7030	X-10		X-1
AGILE			White	Blue	Red-White	Blue-Red	Blue-Gray	Blue-Gray	Orange	Black-White		Yellow		Pink
CENTRAL STEEL	Sul 18	Steelkote 18	White Flash B	White Flash E	White Flash E	White Flash E	White Flash E	White Flash C	White Flosh D				Blukote	Steelkote 110
CHAMPION	Sulcoat	Processed	Blue Devil	Bivedac	Gray Devil	Gray Devil #2	Slack Davil	Red Devil	Blue Devil 85	Red Devil 75	Red Devil 75	Machineable Cast Iron	Non- Machineable	
CHICAGO STEEL			Ductone P	Ductone AC	Ductone NAC	Ductone AC			-				Bluestreak	E-75 E-110
GENERAL ELECTRIC	Type L	F, H, M or W-4	W-22 or W-22H	W-26	W-20 W-30	W-25 "	W-24	W-23 or W-24	W-52	W-54	W-54	W-80	W-80	Type 1
HARNISCHFEGER	Litecote	Dustcole	AP or AC-1	AC-1	PF, AC-3 or FR	Harcraft or AC-3	DH-2 or FW		CM-50	CM-50				110
HOBART	Sulcoat	Sulcoat	55	AC-55	11	AC-77		1111	885		1111111			
HOLLUP	30-XL	30-8	Sureweld 8	Sureweld C	Sureweld N	Sureweld C	Sureweld F	Sureweld A	Sureweld MLY	Sureweld MLY.A	Sureweld MLY-A	CI-22 Arcast	G1-8	70
INCOIN		Stable-Arc Softweld	Fieetweld 5 Fleetweld 35	Fleetweld 5 Fleetweld 35	Fleetweld 7	Fleetweld 37	Fleetweld 9	Fleetweld 9	Shieldarc 85	Fleshweld GHT	Fleetweld 9 HT	Softweld	Ferroweld	Hardweld
MARQUETTE	Sulcoat	Dustcoat	151 31-DR	151	151 25.ADS	151	33-ADS	33 ADS				42		
McKAY	21	2 or 3	15		116	116	91	91	715	716	716			
METAL & THERMIT (Murex)			Vertex	Type A	Genex	Alternex	Fillex, Type FHP or F	Type FHP or F	Molex	Type M Carbon MLY-50	Carbon Moly. 50			
PAGE	8 Rust Lime		υ		F or CR	AF								H.C.
REID AVERY	D or Blue Label		HD-7	HD-11	HD-8	HD-13	20 HD-6	HD-5	7.4	99	H-D \$4			82
A. O. SMITH			. SW-10	SW-15	SW-11		SW-35	SW-20	SW-75	SW-73 SW-76				
UNIVERSAL POWER	Staidare B	o	Hevi-Koat R.P.		Hevi Koat SP-2		Hevi-Koat F.F.	Easy Weld C-2						
WESTINGHOUSE	18 Sulcoat	18 Sulcoat	Flexure AP	ACP	SW	FP SW	Hexarc DH	Flexure DH	AP Moly	DH Moly	DH Moly.			Hardentough 1D
WILSON	Sulcoat 17	17 Dipped Coat or 18	N-86	530	107	520 or 520A	105	851 or 105	Alloy Rod A	Alloy Rod B	Alloy Rod B	12	44	*

Listed in the chart are various types of electrodes for arc welding of ferrous metals (except stainless steel) in different positions and with a-c and d-c power. Basis of comparison of types of electrodes produced by 21 manufacturers are the American Welding Society Classification Numbers.

Data from Allis-Chalmers Manufacturing Company

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READER'S QUIZ

CAPACITOR MOTOR

UESTION 208-We had an air blowing unit motor, of 1120 hp., . 1550 rpm., 110 volt, single phase capacitor motor with a speed control (a potentiometer type rheostat control). When the rotation was reversed, its speed dropped to about 35 percent of its nameplate reading. That is, the highest speed of the motor was at its low point and the speed dropping almost to zero as the speed regulator was turned to its high speed point. Upon dismantling the unit and testing out the motor, we discovered that the capacitor was short-circuited. Can anyone explain how this shorted capacitor affected this motor producing the mentioned effects?

TO QUESTION 208—A split capacitor motor with rheostat speed control is connected so that the starting winding receives full voltage and the rheostat is connected in the main winding circuit and therefore influences the cu. rent in the main winding only.

With the capacitor shorted out of the circuit, the motor would have very low torque, this being the cause of the low speed mentioned in the question. The object of the capacitor is to create a force which has a 90 degree relation to the force created by the main widening thus producing torque to turn the rotor.

In the case in question, the main winding and the starting winding with capacitor shorted have different values of inductance so that the current through one winding is out of phase with the voltage to a greater degree than the current in the other winding, thus producing torque enough to turn the motor rotor at a certain speed.

The question states that the motor runs at near zero speed when the rheostat is in the high speed position or in other words when the resistance is cut out of the circuit.

The reason for the low speed is that the two windings are so near alike and the inductance values are so near the same that there is just enough torque produced to turn the rotor but not enough to accelerate.

When the resistance is in the circuit of the main winding or in other words when the rheostat is turned to the low speed position, it changes the inductance value and power factor of the main winding so that there is a greater difference in phase relation between the two windings than in the first case and hence greater torque and speed are the result.

Since the windings were not designed to operate without a capacitor in the starting circuit, full speed cannot be obtained in either of the cases described.

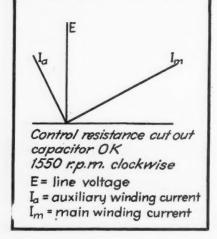
—B.A.S.

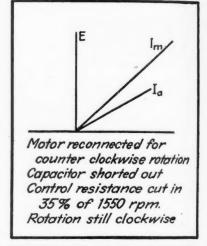
TO QUESTION 208—The capacitor motor is a split phase motor, using an oil capacitor in series with one winding to obtain a large phase difference.

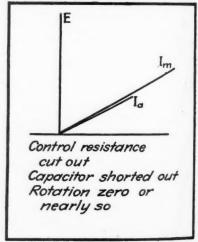
One winding has enough inductance to draw 50 percent of the current directly, e.g. when the capacitor is shorted; or 50 percent of the current, when the capacitor removes the choking effect of the inductance.

Another source of trouble can be in the potentiometer supplying 50 to 110 volts to the motor, when the motor is between A and B, and 0 to 50 volts when the motor is between B and C.—H.S.

TO QUESTION 208—The information is lacking to some extent. I think the motor is one that is







known as a single value capacitor motor—sometimes called a permanent split phase capacitor motor—commonly used in fan applications. The speed control is accomplished by varying current in main winding with small auto transformer or sometimes with a small rheostat, as in this case.

In changing direction of rotation of the motor the capacitor was shorted out in some way. This caused the auxiliary winding current to lag the line voltage instead of leading it as it should have. This lag was greater than the lag of the current of the main winding with control resistance all cut in. As a result, the difference in phase relation between the current in the two windings was very

small giving very little torque. This caused a speed of 35 percent full speed. Direction of rotation the same as before the change was made. Now, by decreasing the control resistance, the main winding current increases but its phase relation in respect to line voltage also increases, making the phase difference between the currents of the two windings decrease, causing decreased torque and speed. As this difference of current phase relation approaches zero, the speed also approaches zero. This would take place when control resistance was all or nearly all cut out.-G.L.S.

CHARACTERISTICS OF MOTORS

UESTION 209-We have 25-220 volt 3 phase series delta connected four pole motors ranging from \(\frac{3}{4} \) to 5 horsepower. The insulation is good and the motors are of a good make.

We wish to operate these motors on a 440 volt 3 phase circuit. Is it practical to reconnect the existing windings in a series star (wye) connection and operate them on the 440 volt service? What would be the characteristics of the motors under the new connection? Will it be necessary to rewind the motors for 440 volts?-T.B.B.

QUESTION 209-The motors will operate satisfactorily on 440 volts if the windings may be gotten at in order to change from series delta to series wye connection. The actual rating as a wye connected machine would be 1.73 times 220 equals 382. If the motors were operated at 440 volts, this would be an over-voltage of approximately 15 percent. The change in characteristics of the motors will be as follows:

- (1) Temperature rise less at full load
- (2) Starting current increase
- (3) Full load current decrease
- (4) Higher overload capacity
- (5) Power factor decrease
- (6) Efficiency approximately the same near rated load, less at low load.
- (7) Full load speed slightly increased
- (8) Starting and maximum running torques increased.-C.P.S.

TO QUESTION 209—If the 25 A motors can be delivered to the shop at one time and rewound with nine leads making them dual voltage motors, it seems to me that would be the most practical way to make the cut-over. Perhaps it would be possible to rewind the motors one at a time for dual-voltage and put them back in service on the 220 volt supply until all are rewound. Then a short time will be required to cut them all over to the 440 volt supply.



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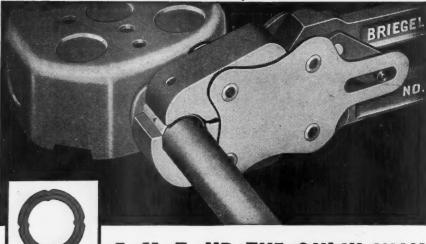
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Lock fuses and clips to-gether. Reduce resist-ance—eliminate burnt fuses and clips—lost production—unnecessary shutdowns and wasted current. There's a size for every clip. Write for Bulletin #6



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• Radically different, the new M. & W. Non-Inductive Cable Rack is designed for A.C. or D.C. systems. Racked cables only partially surrounded by metal eliminates any chance of induced current in the rack. Impedance reduced with cables mounted in delta formation. Rack of one-piece construction... installation of cables made quick and easy through the use of split bushings.

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hanging assignments with Paine Spring Wing Toggle Bolts. They assure safe, permanent support in hollow material—are easily inserted—and will not pull out or work loose. Available in several head styles in standard bolt diameters from \(\frac{1}{8}'' \) to \(\frac{1}{2}'' \) in standard lengths.

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and HANGING

If the present windings are changed to wye and connected to the 440 volt supply, they would have to work on the basis of 15 percent over-voltage, which is in excess of that allowed by most motor manufacturers, unless, however, your power supply could be reduced to around 400 volts.

The characteristics would not be altered if the terminal voltage on the wye connection was kept at about 380 volts .-E.J. K.

TO QUESTION 209 - These A. motors were probably designed to operate on 220 voltage with an allowable 10 percent over or under voltage. If reconnected from series delta to star, it should then operate on 380 volts. The difference between your 440 and 380 would be a 16 percent over-voltage. This would give you increased torque and horsepower, but the motor would run above normal temperatures. If the motor runs continuously, it will soon burn up, but for short periods of operation, you could operate indefinitely. If these motors are to run continuously and carry full load, my recommendations are that you rewind them for 440 volts.-F.F.

TO QUESTION 209 - The series delta connected 220 volt, 3 phase motors reconnected series star for operation on 440 volts would be operating at about 16 percent over-voltage. The proper voltage would be 1.73 times 220 or 380 volts. The accepted permissible limit of over-voltage on induction motors is 10 percent. Operation on a 440 volt supply with motors reconnected series star will probably be unsatisfactory, the extent depending on the percentage of loading and the design of the individual motor. For instance, with a 16 percent over-voltage and half load, the motor is likely to run hot enough to burn out, while at higher loads, the effects of over-voltage would be less pronounced. In general, how-ever, the effects of a 16 percent voltage increase on the operating characteristics of the motor will be as follows:

At full load, the line current will decrease only about 9 percent. Secondary circuit currents which are proportional to the slip will vary inversely as the square of the voltages and will be about 380 x 380/440 x 440 or 75 percent of their normal values. Core losses will be increased about 1.8 times the percentage of voltage increase 16 x 1.8 or 29 percent due to the increase in flux per unit area in iron. Windage and friction losses will be slightly higher as a result of decreased slip but may be neglected. At full load, the lower line current with the resulting lower copper losses more than offsets the increase in core losses. At lower loads, iron losses become increasingly larger in proportion to the copper losses. The efficiency, therefore,

varies from slightly higher than normal to about 20 percent lower at half load. The magnetizing current will increase as the square of the line voltage if the iron is working below the saturation point. The percent leakage will decrease. The result of these two effects will be an increase causing a reduced power factor. The extent of this reduction will depend on the loading and may vary from five percent at full load to 35 percent at half load. The starting and maximum running torques will be higher in proportion to the square of the voltages which is 400 x 400 / 380 x 380 or 34 percent. Inasmuch as the decrease in copper losses at full load more than offsets the increase in windage, friction, and iron losses, the motor will run about 5 degrees centigrade cooler at full load. While the synchronous speed remains the same, the full load speed will be about 1.3 percent higher due to increased torque. The overload capacity of the motor will increase about 34 percent while the starting current becomes larger by about 20 percent. There will also be a marked increase in the magnetic hum of the motor.

The allowable percentage change in the foregoing factors varies in different machines and it is not safe to assume that a given percentage change in voltage of any winding will produce a certain percentage change in each of the factors. It is evident, however, that the various effects will be more pronounced and objectionable as the percentage of overvoltage become larger.

Assuming that the change from 220 to 440 volt supply is unavoidable, the proper remedy would be either to have the motors rewound with turns per phase increased in the same percentage as the overvoltage using a correspondingly smaller size magnet wire or to use a 2 to 1 step-down transformer of suitable capacity, whichever is the more economical.-R.G.C.

SERIES STREET LIGHT CIRCUIT

UESTION 210—I have a series street light circuit of 52 lamps, 6.6 amps., that has shunt tran formers in the fixture head. This transformer causes a lot of noise on the telephone line when the lamp burns out, but does not bother the radio. I would like to know where the trouble is, and how to overcome it .- R.T.L.

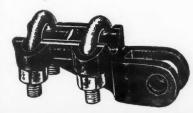
TO QUESTION 210 - The A. trouble is in the film cutout, insulators or transformers. I would use a good grade film cutout, which is designed for 6.6 amp. lamps. It is the

"EFFICIENCY" DEVICES FOR CONDUIT AND CABLE SUSPENSION



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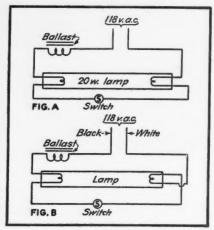


AEROVOX CORP., NEW BEDFORD, MASS., U.S.A. Expert: 13 E. 40th St., New York 16, N.Y. • Cable: 'ARLAB' In Canada: AEROVOX CANADA LTD., Hamilton, Ont. duty of the film cutout to produce a low resistance short across the lamp terminals, whenever the lamp burns out.

Should the film cutout have too high a breakdown voltage, then the socket or bulb terminals, etc., will act as a spark gap, and prevent the film cutout from operating. The cutout will sometimes establish a high resistance short, which is just as bad. Since many things can prevent the proper operation of a film cutout, you will have to examine the insulators and transformer occasionally.—H.S.

Can you ANSWER these QUESTIONS

QUESTION K9—Why should the lamp blink when hooked up as in Fig. A and when hooked as in Fig. B the blinking is elim-



inated? The voltage at the line was 118 volts. The black wire was hooked to the one side of the ballast and all other conditions seemed proper in every detail.

QUESTION L9—We have a Hobart C.P. battery charger rated at 300 amps. at 9 volts. We would like to know if the fields of this unit can be rewound for use as a welder without rewinding the armature. If so, what is the formula?

—F.H.

QUESTION M9—In regard to load surveys of industrial plants, could anyone tell me what value they would be in an industrial plant using about 5000 kw. divided evenly into a-c and d-c power. Now if one wanted to carry out a load survey in a plant of this size, what would the cost approximate in the way of instruments, and also what types of instruments would you suggest buying for the survey? How regularly would you suggest that the surveys be made?

—E.J.K.

PLEASE SEND IN YOUR ANSWERS BY APRIL 1



1; 2; 3, 4, 6, 8 pole interchangeable contact units

Interchangeable contact units, 1 to 8 poles, can be assembled in standard plug shells and receptacle housings to make any desired unit to meet individual requirements for any portable electrical equipment. The protected female contact unit can be assembled in either plug or receptacle for safety in the line side of the circuit. Fusible types and units with one pole grounded are also available.

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OF A-B MAINTENANCE—
FREE CONTACTS



New

This is how the double break, silver alloy contacts on an Allen-Bradley solenoid starter look at the start of a test involving 50,000 operations. Note the generous size of these contacts.



This unretouched photograph shows the same solenoid starter contacts after 50,000 operations. Contacts are black, but are in just as good condition as at the beginning of the test.



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Strange as it may seem to the maintenance men trained to file or dress the contacts on their motor starters, the silver alloy contacts on Allen-Bradley



solenoid starters never require maintenance of any sort. Any oxides that may form on these contacts are good electrical conductors. That's why the contacts are good for millions of operations without attention.

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- 1 Moving Part—1 Chance for Trouble
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It's the amazing simplicity of the Allen-Bradley solenoid starter that makes it so trouble-free. The only moving part is the simple plunger which carries the movable contacts. There are no pins, pivots, or bearings to corrode and stick...no flexible jumpers to break. And the double break, silver alloy contacts never need filing, cleaning, or dressing. With an Allen-Bradley solenoid starter you can get millions of trouble-free operations. Just install this starter... and forget it!

Allen-Bradley Company
1316 South Second Street, Milwaukee 4, Wis.

Right—Bulletin 709 across-the-line solenoid starter. Note its attractive appearance, white cabinet interior, and generous wiring space.

ALLEN-BRADLEY

QUALITY\$



Old Cotton Mill Goes

Modern

ıble

ou can

ns. Just

[FROM PAGE 57]

and tends to emphasize neatness and cleanliness around the mill. In this case, four wires from the bank of transformers were run to the adjacent boiler room service switch where the magnetic switches were connected for operating the stoker and boiler-feed pump on three-phase, 208-volt current. Right next to the service switch, the light switch (three-pole, solid neutral, plug fused) was connected to the 120-volt light circuit through one fuse and the neutral wire, and to the 120-volt boiler control through the other fuse and the neutral wire.

The main mill service switch, a fourpole, solid neutral, 125-250-volt, fused
(three fuses) switch, received the four
service cables for distribution to lights,
unit heaters, humidifiers, drinking fountains, refrigerators, and pilot lights.
This main service switch was located in
the shop section of the mill, on the first
floor, adjacent to the lighting transformer bank, so that there would not be
a long and extended run of cable to
cause an excessive voltage drop in the
line.

From the main switch a circuit of two hot wires and the neutral fed through a fused switch to the circuit breaker panel for lights on the second floor. Another circuit of two hot wires and the neutral fed through another fused switch to the circuit breaker panel for lights on the first floor. Still another circuit of two hot wires and the neutral fed through a fused switch to the panel for pilot lights, outside and yard lights, steam unit (fan type) heaters, elevator shaft lighting, drinking fountain receptacles, refrigerators in the lunch room and toilet lights.

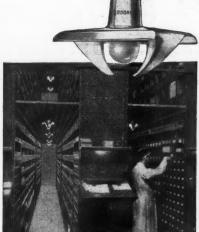
The arrangement of the circuits from the main mill entrance switch was at a well-nigh perfect balance in the load on all three phases of the hot wires, without showing any floating load on the neutral wire.

The steam heating system is boosted in its effectiveness by the use of fan-type heaters throughout the mill with thermostatic control on each unit, the thermostat being mounted above the reach of the operators and set to compensate for the elevation in the heat zone.

Thus it may be seen how one mill has gone modern, taking advantage of all the latest developments in the electrical construction industry, to make it better equipped to meet the business competition ahead.

The STOCKLITE works all the angles Good illuminate

Busy little reflected illuminating stock of angles—and the them all.



The Stocklite is finished in permanent porcelain enamel; easy to keep clean.

Busy little reflector! For the job of illuminating stock rooms has a lot of angles—and the Stocklite works them all.

It starts by getting the utmost efficiency out of the lamp—by working harder—in the right directions. It distributes the light in a way that prevents wasting it where it isn't needed. Light is directed to the sides to build up intensities where it counts most—on shelves from top to bottom row, and into bin interiors. It eliminates glare, yet enables workers to read fine print or small parts numbers anywhere in the aisle. This means more expeditious handling of orders, fewer mistakes.

If you have a stock room to illuminate, write for Bulletin 91!

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BULLDOG LO-X Ventilated BUS DUCT INCREASES POWER . . . DECREASES VOLTAGE DROP

Pioneer in the field of Plug-in Bus Duct for Branch Circuits, BullDog also leads with a Low Reactance (LO-X) Feeder Type Bus Duct in which exceptional design assures outstanding performance.

Using a unique method of arranging bus bars, termed "paired phasing" and mounted in an open mesh casing of expanded metal, BullDog Ventilated LO-X Feeder Duct transmits current with less reactance, lower voltage drop and reduced operating temperatures.

Available in ratings from 600 Amperes to 4000 Amperes, 600 Volts or less, it is the most efficient and economical distribution system now available for Feeder and Welder Circuits.

There is a BullDog field engineer in your vicinity ready to serve you—or if you prefer, write us direct for descriptive Bulletins.

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Panelboards—Switchboards—Circuit Master Breakers—Universal Trol-E-Duct for
flexible lighting—BUStribution Duct for
"Plug-in" power—Industrial Trol-E-Duct
for movable "loads."

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MOTOR SHOPS

PIPE BENDER DOUBLES AS HYDRAULIC PRESS

From the Dooley Electric Company of New York City comes a new application for the familiar and widely used portable hand hydraulic pipe bender. Hydraulic pressure, acting through either a horizontal or vertical press, is a requisite in the machine shop. It is also highly convenient and frequently imperative to have such power available in the field for exerting a high powered thrust. Typical examples for field application include the removal of brake drums from shafts and pressing shafts in or out of armatures or pulleys.

Anthony Csicsak of the Dooley shop thought of the power contained in the handy, 65-ton capacity Greenlee handhydraulic pipe bender and designed a yoke to harness this pressure for use on outside jobs. All members of his yoke assembly are from inch-thick steel stock with connecting pins an inch in diameter. The members of the assembly include two shoulder plates (6 inches by 2 feet), four flat struts (3 inches by 6 feet), two terminal cross bars (3 inches by 2 feet) and six pins (1 foot long).

Eight holes are drilled in the shoulder plates; six located on the longitudinal axis and spaced 2, 5 and 8 inches from either end, and two symmetrically located either side of the transverse center line and drilled to coincide with the

pin holes through the housing of the Greenlee ram. Steel dowels pass through these coincident holes, holding the plates firmly to the housing above and below the ram piston. The ram is then placed in working position with the pressure piston axially in line and in contact with the shaft to be pressed.

The four struts are dowelled to the ends of the shoulder plates and arranged to bracket or box the worm and drum. Dowels are slipped through holes in the far ends of the struts, creating a double-barred cradle for the terminal cross plates which are shipped between these dowels and the drum. Holes in the struts are spaced on 6-inch centers at the far, or cross-plate end, and are spaced on 2-inch centers at the near, or shoulder-plate, end. This combination of holes offers many combinations of length between the two sets of plates.

When pressure is applied to the piston of the pipe bender it is transmitted to the worm shaft and, since the drum is prevented by the cross plates from moving away from the worm, the worm shaft is forced into the drum. To remove the drum from the worm, the pipe bender is set up at the drum end and shorter struts are used to hold the drum. When pressure is applied to the worm shaft it forces the worm from the drum.

A single man can transport the equipment, set it in place and perform the indicated operation.

Heavy steel shoulder plates are pinned to housing of hand hydraulic pipe bender. Struts box worm shaft and hold terminal cross bars for bearing purpose.

SCRAP PROFITS

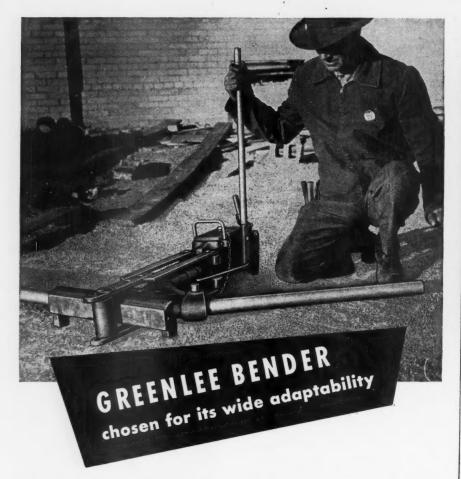
The success of the City Electrical Service and Equipment Company of Newark, N. J., is largely due to a stockroom containing hundreds of motors of every known characteristic. The stock has been accumulated by retaining motors replaced by new ones, by purchasing units housed in buildings being razed and by salvaging motors damaged by fire, water, acids, cement and sand. Literally, scrap has been turned to profits. The large stock and an east-coast "shopping service" have been instrumental in upholding the company slogan of, "Let us fill your motor pre-



Scotch electrical tape is applied by a hand-cranked edging machine which automatically folds the tape over the edges of slot insulation paper and seals as the paper is rolled through a metal guide.

scription. If we haven't got it—we'll get it!" Motors with standard characteristics are reconditioned immediately and placed in stock for resale or exchange while motors of antiquated design are inventoried and placed in the warehouse until specifically requested. Conditioning these seldom-called-for motors only when the request has been received saves the possibly-useless expense of fruitless labor and eliminates rechecking for minor defects after a long period of storage.

Attention to small details is necessary in maintaining reputations for responsibility. Motor shops recognizing this truth, closely inspect finished products



"Bending various sizes of conduit, pipe and tubing is simple, fast work with the highly adaptable Greenlee Bender," say C. H. Simpson & Son, electrical contractors, Cheyenne, Wyoming. "And another outstanding feature is the fast-working bus-bar bending attachment."

"On current jobs, we are using our four Greenlee Benders on approximately 3,000 feet of conduit and pipe ranging from 1¼" to 3" sizes," continues the report, "and we save 20% or more on labor hours, 15% on material spoilage, and 50% on fittings and manufactured bends. That means a Greenlee pays for itself quickly."

Shown above is a GREENLEE No. 770 Bender with an I.P.S. Radius-Shoe Attachment used on Simpson jobs for making full 90° bends with one stroke. For this and whatever other type bending work you have—there's a GREENLEE to do it. One man operated, portable . . . for accurately bending pipe up to 4½", rigid and thin-wall conduit, tubing, bus-bars.

Get information today on these and other GREENLEE timesaving tools.

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OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK
Hand Benders • Joist Borers • Cable Pullers • Knockout Tools • Pipe Pushers



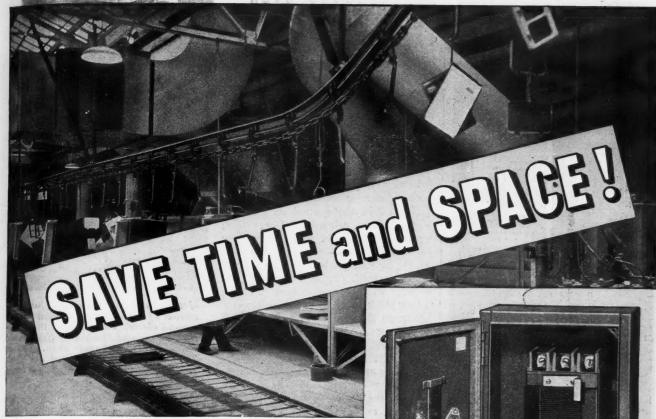
Efficiency saves time and adds profits as the scotch tape slot insulction edger and the portable grinding wheel are employed for improving appearance and physical characteristics of finished products.

from welds to windings before delivery. The City Company makes a good job better by guinding welds to match the surface of surrounding metal and by improving the physical properties of slot insulation paper using scotch electrical tape and a special edging machine.

The portable grinding machine, combining standard component parts, was made in the shop to provide a means for finishing rough welds. A ½ hp. Kingston Conley motor is mounted on a movable Sioux steel stand and transmits high speed rotational grinding power to Diehl grinding wheels through a Craftsman flexible shaft. A 30-foot rubber covered plug-in cable permits the portable unit to be quickly connected to the outlet most conveniently situated with reference to the welded motor. The flexible shaft allows the grinding surface to be placed in any position.

Slot insulation is edged with scotch electrical tape applied by a Minnesota Mining and Manufacturing edging device. Edging the insulation increases the low tear strength of the paper, puts a protective edge on the insulation, prevents windings from cutting into the edges and increases the dielectric strength. The slot insulation paper is placed against a guide and rapidly run through a metal groove by means of friction wheels turned by a hand crank. Scotch electrical tape is automatically folded over the paper as the insulation passes betweent the edges of the groove and is sealed as the paper moves forward. It is also possible to replace the hand crank with a foot controlled fractional hp. motor.

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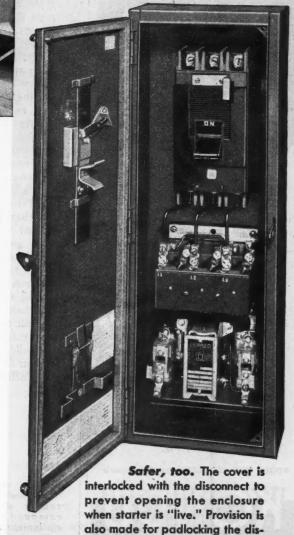


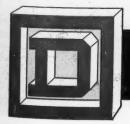
Square D Front-operated Combination Starters

• You save time by using combination starters. Since the disconnect (switch or breaker) and the magnetic starter are housed in one enclosure, you cut mounting time in half and also save wiring time.

A combination starter takes less space than two separate devices. These Square D frontoperated units save still more space. They are especially suitable for "ganging."

Square D front-operated starters are available in three capacities—sizes 0, I, and II. Some types of larger sizes are side-operated. For informative bulletin, address Square D Company, Industrial Controller Division, 4041 North Richards St., Milwaukee 12, Wis.





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connect in the "OFF" position.



You can use Thin-Wall Tubing at ANY outlet of ANY Kondu fitting. Just slip out one bushing and slip in another no extra pieces are needed.

Change boxes without disturbing conduit—at any time. Or you can install a conduit line before the fittings are delivered. Every Kondu box is a union.

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A full line —many hundreds of types.

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KONDU MFG. CO. LTD., Preston, Ontario



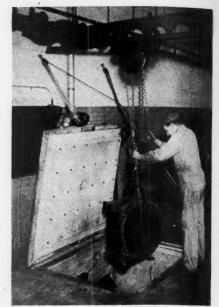
UNDERGROUND OVEN SAVES SPACE AND LABOR

When the Rockford Power Machinery Equipment Company, Rockford, Ill. moved into their new quarters well over a year ago, they carefully designed their motor repair department to suit their specific needs and to effect what operating economies they could. One of the most unique of their developments is a novel underground electric bake oven built to save space, back-breaking labor, time and current consumption.

Nestled in the ground so that the hinged covers, when closed, are flush with the floor is the two compartment oven, 8-ft. long, 4-ft. wide and 6-ft. deep. Six-inch slabs of concrete lined with fire brick comprise the walls and bottom. The hinged covers, made of 2-inch plank with a 1-inch thick Transite lining on the inside, each contain a 3inch vent opening for elimination of fumes. At the back of each half of the "heat well" is another 3-inch vent connected to an exhaust duct fitted with a fan. According to E. K. Bacon, manager of the company, it is necessary to use this exhaust fan only when large stators are being baked. The building has a high roof and there is sufficient natural draft to draw off most of the fumes through the cover vents.

The two-compartment design gives an added flexibility to the unit. A one-inch thick Transite sheet, raised and lowered by chain hoist, divides the oven into two equal sections—one section being used for small motors and parts; both sections as a unit for large motors up to a 300 hp. stator in size.

The oven is heated electrically with a total of 12 Nichrome ribbon heaters—six in each half. These 8½-amp., 220-volt, single-heat units are automatically controlled by a Bristol thermostat mounted on the building wall directly behind and about four feet from the rear wall of the oven. Each half of the oven can be in-



Motor stator being lowered into one section of the two-compartment underground electric bake oven at the Rockford Power and Machinery Equipment Company motor repair shop. Center Transite divider is removed and both sections used as a single unit for large motors.

dependently heated and controlled. The heating units, installed on each side of the oven and approximately 18 inches from the bottom, are protected from mechanical injury by a galvanized sheet iron shield in front of each bank. An angle-iron rack, resting on the bottom of each half of the oven, keeps the work being baked about 18-inches above the oven floor.

In December, 1944, with outside temperatures at 18 degrees below zero, a 24 hour test showed a drop of only 100 degrees (230 to 130) with no additional heat being applied to the oven.

Approximately 20 percent in current consumption is saved due to the thick concrete walls, fire brick lining and earth surrounding the unit. This is in addition to the incalcuable saving in drudgery and the inherent economies in equipment handling.

Interior view of "heat well" with center divider removed. Note equipment racks and metal shields in front of electric heating elements.



Electrical Contracting, March 1946



Tell me, Buster, WHO CAN THIS RACO be ?

- Don't let that question stump you. RACO is the trade-mark of All-Steel's complete line of improved switch boxes and outlet boxes. It's the uniform line that's preferred by builders, contractors, and architects the country over . . . and here's why:
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DO-21-N-3 3½" dia. DO-16-N-3 4" dia.

Use Raco clamp type boxes to solve many of your connector worries.

DO-21-N-3, 3½" dia. is widely used with non-metallic cable.

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DO-30-N 3½" dia. DO-31-N 4" dia.





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Long life fans by Westinghouse

PLANTS IN 25 CITIES ... OFFICES EVERYWHERE

WESTINGHOUSE ELECTRIC CORP. · SPRINGFIELD, MASS.

ROLLING MILL SPEEDS COMMUTATOR REPAIRS

Repairing motors on a sub-contract basis for many of New York City's elevator maintenance companies is the basic industry of the Wood-Warner Engineering Company. The organization is geared to give immediate service due to a comprehensive stock of spare armatures, windings and commutator bars. Beveled commutator bars normally are purchased from manufacturers but an emergency occasionally arises dictating the use of bars of non-standard depth, thickness or bevel. Awaiting delivery of special bar stock entails the inconvenience of prolonged car shut-downs so the emergencies are met by rolling the bars to specification on a rolling mill designed and constructed in the shop.

The rolling mill is powered by a veteran 4 hp. Sprague motor with a rated speed of 1200 rpm. Through a gear train this speed is reduced to a final roller speed of 4 rpm. and, with hardened steel rollers 3 inches in diameter, the lateral speed of the bar stock passing between the rollers is approximately three feet per minute.

The bevel and pressure of the rollers is adjusted by four jack screws (two located above and two below the bed plate of the mill) which raise or lower either end bearing of either roller to give any desired angle. Mounted parallel to both rollers are small micro-leveling drums with leveling bubble glasses pivoted in a vertical plane on the drum sides. Calibrated adjustment wheels, graduated in thousandths, are mounted on the drum shafts. Cams, activated by turning the adjustment wheels, tilt the levels to the degree desired of the rollers. The roller ends are then raised or lowered by turning the jack screws until the bubbles of the levels bisect the tubes.

To provide flexible connections between the gear train and the roller shafts, the two steel connecting rods receive and transmit rotational power through universal joints at either end.



Commutator bars are bevelled to specification for non-standard armatures.

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yourself, and see! Note their
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IT'S EASY TO SEE WHEN IT'S

DAY-BRITE

MODERN LIGHTING

INDIRECT FLUORESCENT LIGHTS DRAFTING ROOM

Recently the Illinois Bell Telephone Company relocated the engineering drafting personnel at its Bell Telephone Bldg. in Chicago to make room for additional telephone equipment. During the remodeling of the new quarters, a modern fluorescent lighting system was installed—prominent because of its appearance and the quantity and quality of illumination it provides.

Relighting of the old quarters had been under consideration for some time but the direct current service in that section of the building and wartime material shortages precluded immediate action. The old area had been illuminated to approximately a 12 footcandle level by 300 and a few 500 watt incandescent indirect, silvered mirror reflector fixtures mounted on 10-foot centers.

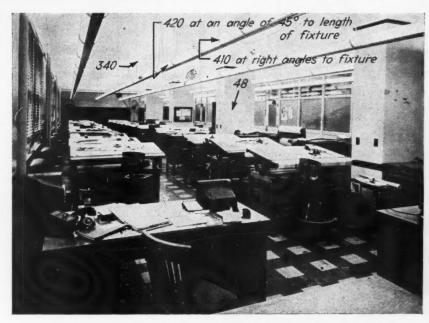
The new location of the drafting room presented numerous factors that were considered in the choice of a lighting system. Being on a street side of the building, it was noisy. Decibel readings indicated the need for acoustic tile treatment of the ceiling.

The final choice of an indirect fluorescent lighting system was based on extensive engineering and economic studies made by C. B. Pederson, electrical engineer for the company. A student of planned lighting, he inspected numerous installations in the area; found the basic weakness of most designs to be high brightness and inability to maintain calculated maintained intensity—primarily due to maintenance difficulties. Maintenance ease, initial and operating cost and quality of illumination were the guideposts of his design.

Mr. Pederson's studies of various installation methods revealed the following interesting facts:

1. Installation cost of a suspended acoustic tile *ceiling only* (no lighting troffers included) would range between \$1.50 and \$2.00 per square foot.

2. Installation of acoustic tile direct to existing ceiling would cost approximately 50 cents per square foot (this method was used). In comparison—the cost of a suspended ceiling without fixtures would be greater than that for acoustic tile direct to existing ceiling with the cost of surface type fixtures included.



Continuous rows of indirect, luminous panel fluorescent units provide 75 foot candles (maintained) of evenly distributed shadowless lighting on the drawing boards. Numerals in photo indicate foot-lambert (brightness) values recorded after installation was in use. Units, parallel to windows in this main area, are controlled by column switches. (Figure 1)

3. Initial and maintenance cost of a ventilated, illuminated glass panel ceiling far outweighed the lighting benefits obtainable.

4. Despite their high efficiency, suspended, semi-indirect, glass enclosed fluorescent units would not provide the deired quality of illumination.

5. All-metal, totally indirect fluorescent fixtures would produce a relatively high brightness contrast between the dark lines of the fixtures and the illuminated ceiling.

6. Transparent reflectors with low

Tickets for Lighting Show

A DMISSION to the International Lighting Exposition at the Stevens Hotel, Chicago April 25th through 30th is by ticket only. For yours, send in the following coupon and your tickets will be forwarded promptly. There is no charge.

The Editor Electrical Contracting 330 W. 42nd Street New York, 18, N. Y.

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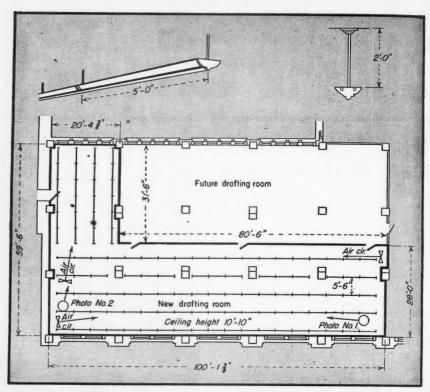
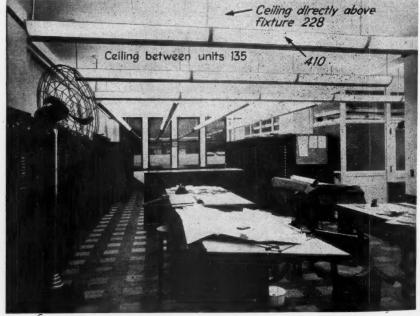


FIG. 1—Layout details of the new fluorescent lighting at the Illinois Bell Telephone Company drafting room in Chicago. Note mounting details of fixtures (above) and location of ventilating fans.

brightness values seemed to be the answer. The maintenance of one candle-power per square inch (which years of experience proved to be good engineering practice) was desirable, particularly with the fixtures in the line of sight. The more uniform color quality and brightness values of glass, compared to other diffusing mediums, led to its choice as the fixture reflector.

An indirect lighting design was chosen because it produced a more even and practically shadowless distribution, eliminating the need for mounting the fixtures at an angle to the drawing boards to eliminate dense "T₅-square shadow."

The specific fixture selected was an indirect unit with glass reflector and two 100-watt, 3500 degree white, fluorescent lamps (See Fig. 1). It provides 90 percent indirect and 10 percent direct illumination and is 75 percent efficient. Theoretical maximum



Print and tracing storage area is illuminated by same type of unit mounted at right angles to windows. When room is enlarged these units will be reinstalled parallel to those in foreground. Numerals indicate foot-lambert (brightness) readings.

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MITCHELL FOR TOP LIGHTING VALUE

brightness value of the unit is 435 foot-Calculations made after lamberts. studying the ETL curve of the fixture indicated that, with a ceiling reflection factor of 85 percent, the ceiling brightness would approximate that of the fixture.

With the type of fixture chosen, the size of fluorescent lamp was the next problem to consider. Cost studies indicated that the "cost per fixture, per square foot of area lighted, per foot candle of intensity" was considerably less with fixtures using the 5-ft., 100watt lamp than those using the conventional 4-ft., 40-watt tube. From an annual charge viewpoint, the use of the 100-watt lamp (despite its slightly lower efficiency) was more than warranted.

The installation was so designed that at no time would there be less than 50 footcandles of light (lowest value just before repainting room and rewashing units). Based on an initial intensity of approximately 100 footcandles, the

maintained intensity is 75.

The floor covering has an overall reflection factor of 25 to 30 percent. A higher factor was desired but the covering installed was the best available at the time. The walls, formerly a buff color, are now painted a pearl gray shade. The acoustic tile on the ceiling, delivered in a flat white color, required

no additional painting.

Figure 1 shows the lighting layout for the 3500 square-foot drafting room area. Continuous rows of fixtures are suspended 2-ft. from the 10-ft., 10-in. ceiling at a 9-ft. mounting height and on 5-ft., 6-in. centers. Fixtures parallel the windows. The offset portion of the area, where fixtures are at right angles to the window line, is now used for storage of tracings and prints. When the drafting room is extended, these units will be reinstalled parallel to the windows to conform to the overall pattern.

Existing home run conduits (one 3/4-in. conduit per bay) were used to serve the rows of fixtures. Circuit rewiring was done with small diameter, synthetic insulated conductors. Lighting is controlled in groups of four fixtures per circuit with the switches mounted in the columns in the center of the area.

Brightness Studies

Quality of illumination-a factor that goes hand in hand with intensity when comfortable seeing conditions are at stake-was a vital consideration in this Considerable attention was design. devoted to brightness values. Readings taken after the installation was in operation confirmed the theoretical brightness values of the fixtures.

Foot-lambert values, as indicated on the attendant photographs, were:

At right angles to the fixture At 45 degrees to length of fixture 420 On the underside of the beam directly above the fixture 340 On the ceiling directly above the fixture On the ceiling between the fix-135 tures On the columns

With the maximum of 420 foot-lamberts at the fixtures and the minimum of 48 in the field of view (at the columns) the ideal 10 to 1 ratio is closely approximated in this installation. At first there was some concern about the underside of the projecting beams $(17\frac{1}{2})$ inches above the fixtures) causing uncomfortable bright streaks at right angles to the field of view. All fear of this was dispelled after the system was in operation. A study of the brightness readings taken at the ceiling and beams bears this out, the ratio between the maximum and minimum values being about three to one.

Room Ventilation

To make working conditions more comfortable during summer months, a simple air circulation system was designed utilizing conventional 36-in. twoblade propeller, pedestal type, five-speed quiet-type fans. In the main area, one fan is located in the southwest corner of the room; a second one in the northeast corner (See Fig. 1). These two units, creating air currents along the length of the room, set up gentle air circulation (average velocity, 125 ft. min.) throughout the area which has a cooling effect, yet does not disturb papers on the desks and tables. A third fan creates air movement in the print storage area of the drafting room.



Lighting for Outdoor Recreation was discussed by J. W. Steiner, Westinghouse Electric Corporation, Cleveland, Ohio, before the East Central Regional Conference, Illuminating Engineering Society, in Philadelphia, Pa., January 31-February 1.

NEW "BLACK LIGHT" HORIZONS

By J. M. GORDON Plastics Engineer New York, N. Y.

With the advent of a plastic filter capable of transmitting near ultraviolet light, fluorescent eye-arresting lamps and fixtures are now available for producing ultra-modern, luminescent effects. Previously, the highly decorative effects of fluorescence could only be achieved through the use of such light sources as the carbon arc, and the mercury vapor high voltage transformer operated lamp.

The combination of the ordinary fluorescent tube and the purple-blue plastic filter provides an inexpensive and flexible source of near ultra-violet light. The lighting engineer can now take the spec-



Theatre carpets, containing fluorescent dyes and exposed to ultraviolet radiation, glow distinctly in darkened theatres and provide safe aisle passage.

tacular of yesterday and convert it into the practical of tomorrow in night clubs, restaurants, store interiors, movie theaters, window displays, hotel lobbies, commercial showrooms, product design, and in numerous applications that will ultimately find their way into home, office, and factory.

Every lighting engineer has at one time or another focussed his attention on the phenomenon of fluorescence. The amazing array of rich colors obtainable from fluorescent pigments activated by near ultra-violet light rays stimulated the imaginations of designers, engineers, and others interested in lighting applications. However, instability of fluorescent pigments was one obstacle to widespread use. "Black Light" applications prior to the war were limited primarily to theatrical extravaganzas, ice carnivals, exposition exhibits, theatre murals and similar uses.

Military requirements for fluorescent pigments and dyes accelerated chemical research. Such war uses as fluorescent treated aircraft dials, signal flags, ma-



new Fluorescent Luminaires, is especially designed to meet the requirements for a highly efficient and flexible luminaire adaptable to a wide range of applications.

The Tyler and its companion units, The Wilson, The Jefferson, The Madison and The Van Buren, are outstanding fluorescent luminaires . . . but they represent only a small segment of the diversified line of Fluorescent and Incandescent Lighting Equipment designed by Pittsburgh Reflector Company to meet every lighting requirement-interior and exterior . . . commercial, industrial and institutional.

If you want up-to-date illumination, take full advantage of the "planned lighting" possible with Pittsburgh Permaflector Equipment. Your nearest Permaflector Lighting Engineer will gladly give you every assistance in choosing the best lighting for your needs. And remember-Pittsburgh Permaflectors are simple to install, easy to maintain and provide maximum lighting efficiency . . . as well as flexibility of application.

Pillsburgh Reflector Company OLIVER BUILDING . PITTSBURGH 22, PA.

MANUFACTURERS OF PERMAFLECTOR LIGHTING EQUIPMENT DISTRIBUTED BY BETTER ELECTRICAL WHOLESALERS EVERYWHERE Permaflector Lighting Engineers in All Principal Cities

OUTSTANDING FEATURES

- Die-formed all-metal parts for precision fit, maximum rigidity and strength.
- Egg-crate louver bottom hinged for easy
- Reflecting surfaces sprayed with heatresistant, baked-on white enamel permanently bonded to steel base.
- •Light distribution controlled by reflector. Reflector easily removed for access to wiring channel.
- Camp holders securely mounted, on heavy gauge support brackets.



Switches by P&S

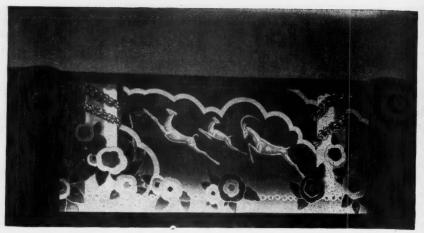
FOR ENDURING SERVICE



• If you need switches — for residential or industrial use or for special appliance applications — consult your P&S Catalog. All precision-made — all backed by over 50 years' experience in the manufacture of wiring devices. Send for your copy of our No., 42 Catalog.

Sold Thru Electrical Wholesalers

PASS & SEYMOUR, INC. SYRACUSE 9, N. Y.



Mural, painted in fluorescent pigments, glows with unusual life and brilliance when irradiated with ultraviolet radiation (black light), from standard fluorescent lamps equipped with UV plastic filters and installed in standard reflector units.

chine gun training bullets, map and chart cases, and luminous tapes and markers revolutionized pigment production to the point where the price decreased to approximately one tenth of its former cost. Coupled with the decrease in price came increased stability and wearability.

In similar fashion, the need for more efficient and flexible light sources was translated into new research and developments on the part of lighting engineers. For example, the use of fluorescent treated dials in aircraft had been under tests for sometime. However, the limiting factor had always been the lamp. Some success was achieved when argon glow bulbs displaced filament lamps. But even though the former reduced the amount of visible light, its low wattage made for low operating efficiency.

The development of special low wattage fluorescent lamps was the final answer. With special phosphors coated to the tubes, near ultra-violet light in the 3650 Angstrom unit region is obtainable. It was immediately forecast that the creation of a suitable filter substance flexible enough to enclose the tube would make for a near ultra-violet source that would incorporate all of the advantages of ordinary fluorescent lighting as well as its ease of installation.

A plastics filter has now been developed which fulfills all those requirements. This new plastics filter is made of a purple-blue plastic that permits the passage of a high percentage of the near ultra-violet rays while it screens out most of the rest of the spectrum.

Made into a tube, this plastic becomes a collar for an ordinary white fluorescent lamp. It filters out visible light and becomes a valuable source of "Black Light" at low cost. This plastic, made to rigid specifications and dyed with a special formula, has a high melting point and enough stability so that it is in no way affected by the heat of the fluorescent lamp.

The combination of fluorescent tube and plastic filter collar thus makes possible for the first time low cost installations and mass applications of "Black Light". Important advantages are flexibility, low cost, and even distribution of light.

One of the broadest outlets for ultra violet lighting effects lies in store interiors and window displays. The modern food, drug, and department store as projected by postwar designs calls for widespread use of strip lighting, raised lettering, large glass areas, and highly decorative wall and column effects. Sheltered by low troughs or reflectors, fluorescent sources of "Black Light" can be integrated with the building design to illuminate selected areas.

Placed in the base of signs, brilliant edge lettering effects may be obtained. By a skillful combination of paint and light, novel and striking methods of highlighting merchandise, may be achieved.

"Black Light" installations are well known to motion picture theatre owners. Colorful and unusual mural and curtain patterns have been designed for many new theatres built within the past ten or fifteen years. However, there has always been the legitimate objections of "spotty" lighting effects, and the difficulty of so placing the lighting units that patrons would not be irritated coming or going by the odd purple light. With the advantages of "cool" and easily adaptable ultra-violet lighting from fluorescent units, the theatre designer is no longer confined to restricted areas in utilizing the effects of fluorescence. In addition, the naturally darkened interior of the theatre offers many interesting possibilities for new applications such as lounge signs, stage and curtain lighting, column effects, illuminated clock faces and so on. Recognizing the advantages of this type of lighting, a leading theatre architect is already planning to use it extensively in a large installation.



A Picture that means more <u>TO YOU</u> than a thousand words

THE lighting fixture that bears this label needs little more in the way of a "sales talk". To everyone interested in the buying and selling of fixtures, the FLEUR-O-LIER certification label is a symbol of mechanical and electrical excellence, satisfactory lighting performance and trouble-free operation.

Over thirty leading fixture manufacturers participate in the FLEUR-O-LIER testing and certification program. Added to the reputation and integrity of the individual manufacturers, the FLEUR-O-LIER Label is double assurance of superior value and satisfaction.

All certified FLEUR-O-LIER fixtures are equipped with Certified Ballasts and Starters, additional assurance of better service from the lamps you use.

FLEUR. O. LIER Manufacturers

Fleur-O-Lier is not the name of an individual manufacturer, but of a group of more than 30 leading fixture manufacturers. Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements.

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to build your sales for Wiring

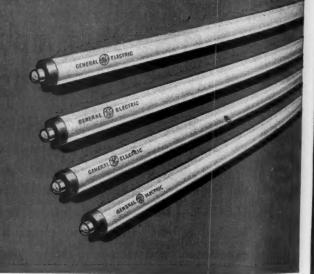


New

Fluorescent Lamps are opening up new sales prospects in homes and stores that are ready and eager to buy better, more modern lighting. The new circular-shaped fluorescent lamps afford many opportunities to get your full share of this fust-growing demand for up-to-date home and store lighting.



Fluorescent Lamps are expanding your lighting business by increasing the demand for long, slender lines of smooth light. They are broadening the list of lighting installations that mean more profitable sales with increased outlets, improved wiring, and more modern lighting.





G-E LAMPS

GENERAL ELECTRIC



Happening...

and Lighting with G-E Lamps



New

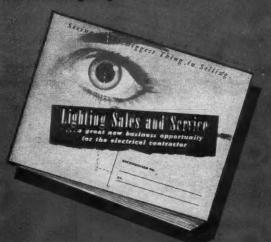
G-E ADVERTISING

To help you realize a full share of lighting sales and profits, General Electric advertising is preselling your customers and prospects... reaching them in more than 40 trade publications and 15 leading consumer magazines. In addition, every Sunday the G-E Hour of Charm reaches 3,500,000 families, supporting your sales efforts by selling the need for better lighting.

New

G-E SALES PROGRAM

light out of ten stores want better lighting . . . and this G-E program helps you find the business and close more profitable sales. An attractive new booklet, "Lighting Sales and Service," gives you all the facts. It's a sales-making basis for your entire commercial activity . . . your G-E Lamp Representative has a copy for you NOW.

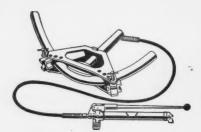


Research is Always at Work to Improve G-E Lamps and Make Them

STAY BRIGHTER LONGER!

IC

1946



When you buy a

BENDER

...check to make sure you get these features:





Plastic letters, impregnated with fluorescent pigments, become luminous with high brilliance when edge-radiated from ultraviolet radiation from standard fluorescent lamp encased in special plastic UV filter.

Although relatively efficient in lighted interiors, "Black Light" is naturally more effective in areas of less than normal footcandles. Restaurants and hotel lobbies, therefore, present natural outlets for fluorescent installations. modern restaurants and hotel lobbies make wide use of striking designs and colors; architects and electrical men have established reputations on just such installations. In combination with fluorescent plastics, which is particularly effective as a medium for this lighting. "Black Light" effects can be widely used on bar fronts, lounge signs, wall and ceiling motifs and others. In fact, in many cases, the emanations from plastic impregnated materials may provide secondary or primary lighting.

. Many of the applications mentioned above will not be out of place in the home. Here, fluorescent "Black Lighting" lends itself to use with drapes, wall paper, floor and table lamps, and such practical places as the medicine chest and night clock.

Inasmuch as the new fluorescent tubes are available in sizes from 4 to 40 watts, many types of electrical appliances may incorporate a "black light" source. At present, a large plastics fabricator is manufacturing a decorative mantel-piece that will conceal a black light source in its base.

Only a few of the commercial lighting applications have been mentioned above. Not to be overlooked is the possibility of applying this method of lighting to industrial and safety uses, directional signs, machinery highlights, road signs and others which can all be fashioned so as to present hard-to-miss surfaces. The progress made in adapting such printing processes as letterpress, silk screen, decalcomania and others to fluorescent pigments indicates another vast field for the application of "Black Light."

Already signs of mass production applications of "Black Light" are evident. Advertisements of "things to come" reveal that automobile interiors, radio dials, stove thermometers will soon bring the magic of "Black Light" to the great American market. One can well imagine the advantage of blending the soft glow produced with "Black Light" with modern radio design. Absence of glare coupled with the full, rich color scheme of the wavebands will make "tuning in" a pleasure in both radio and television sets. Uses such as the above coupled with greater attention to the scientific aspects of fluorescence in colleges and schools will naturally focus the attention of the consumer on the uses of "Black Light" and will create a receptive audience.



One 15 watt fluorescent lamp equipped with plastic black light filter activates plastic sheet behind cutouts and becomes a highly luminous red. Plastic sheet in bottom of sign produces white or green light when ultraviolet activated.



RENGT CENTRAL RIGID STEEL

CENTRAL BLACK



SPANG-CHALFANT

Division of The National Supply Company

General Sales Office: Grant Building, Pittsburgh 30, Pa.

District Offices and Sales Representatives in Principal Cities

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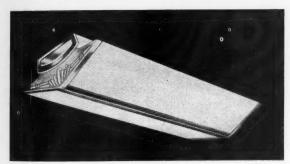
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THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed description, sizes, prices and other data write to the manufacturers' advertising departments, tell them in what issue of ELECTRICAL CONTRACTING you saw the item and they will send full details to you.

EQUIPMENT NEWS

Commercial Fluorescent Fixture

A new shielded commercial luminaire for use in offices, stores, schools and public buildings. Light is diffused through double strength prismatic ribbed glass panels. Panels can be removed for cleaning and servicing. Sockets, starters, wires are accessible. Models available for two or four 40 watt fluorescent lamps. Units may be surface or suspension mounted, singly or in continuous rows. Operates on 110-125 volts 60 cycles a-c. Higher voltages available. Mitchell Manufacturing Co., 2525 Clybourn Avenue, Chicago 14, Ill.



MITCHELL FLUORESCENT FIXTURE

Pulsing Control Drive

This pulsing drive provides single knob precision control of any type of reversible motor. Motor may be continuously rotated or moved in small increments. Slow clockwise rotation of the control knob results in a corresponding motor motion in small increments. The drive works on all standard currents and frequen-



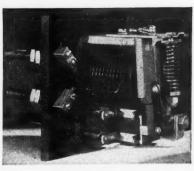
YARDENY PULSING DRIVE

čies. Recommended applications include precision control of valves, flaps, radio tuning elements, cranes, lifts, rollers, presses, machine tools, mixers, or any motor driven equipment requiring more precise and more flexible control than is afforded by ordinary pushbutton methods of control. Yardeny Engineering Company, 105 Chambers Street, New York 7, N. Y.

Magnetic Relay

A new type AYJ relay for d-c operation has been announced to provide almost instantaneous magnetic overload protection on general purpose and mill motor applications, and to prevent damage to hoist, wind-lass and capstan equipment when the load or cable jams on marine control. The single-break normally closed

Pa.

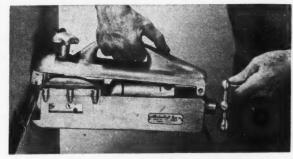


WESTINGHOUSE RELAY

main contacts and the double-break auxiliary contacts are suitable for carrying 5 amperes continously and for interrupting a d-c inductive coil load of 150-volt-amperes maximum. Relays are operated by a series or copper strap wound type of coil. Coils and coil studs are available for currents ranging from approximately 75 to 625 amperes. The coils and auxiliary contact parts are insulated from the relay frames for 600 volts. Westinghouse Electric Corporation, Pittsburgh 30, Pa.

Metal Cutting Saw

Gripping conduit, pipe or round or irregular bars from finch to 1-inch diameter, this portable, power-operated saw will make accurate cuts in ferrous and non-ferrous metals. The gripping vise and saw blade are so related that the latter will cut flush to the surface of the wall or panel to which the conduit or cable may be fixed. It is also adapted to making cuts in a variety of other hard to get at places. Constructed of cast aluminum and precision made steel parts, and embodying geared power, the over-all weight is 14 pounds. Machine-Craft Manufacturing Company, 3805 So. Avalon Blvd., Los Angeles, 11, Calif.

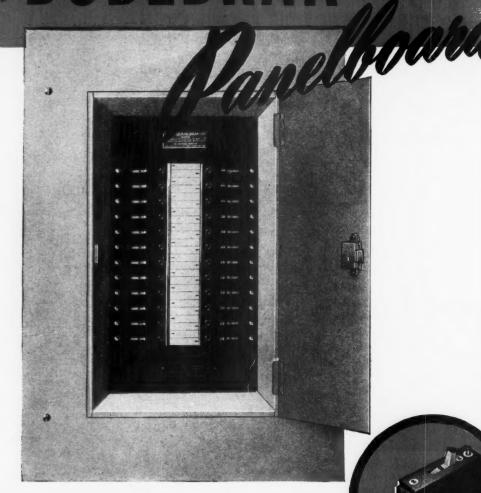


MACHINE-CRAFT SAW

Grank DUBLBRAK CIRCUIT BREAKE

GREATER
PROTECTION

MORE
EFFICIENT
OPERATION
THAN EVER
BEFORE



Here is a panelboard as modern as tomorrow! Designed for lighting and appliance branch circuit protection and control, nothing has been spared to meet every requirement. Compact and attractive to please the architect . . . scores of knockouts, 4-inch gutters, adjustable leveling to please the contractor . . . nothing to replace or service to please the maintenance men . . . years and years of trouble-free service to please the owner . . . and quality materials and workmanship to please ourselves.

Everyone is delighted with this panelboard. Stores, offices, factories, schools, hospitals, commercial and public buildings have found it meets their requirements perfectly.

The @ Dublbrak Panelboard has the "extras" you want. Individual circuit breaker construction.

Automatic thermal protection against overload and

short circuit. Timelag for harmless momentary overload. *Quick* make and break operation on manual and

automatic trip. Red button indicator for speedy location of automatically tripped circuit breaker. Entire front is shock proof and tamper proof. Heavily silvered, double break contacts adds years to the life of the panelboard.

Capacities of 15 to 50 amperes for alternating or direct current. Double or triple pole assemblies with individual trip per pole are available. Write today for Bulletin No. 67 giving specifications, prices and many helpful suggestions.

Frank Adam

P.O. Box 357 St. Louis, Missouri he of fo

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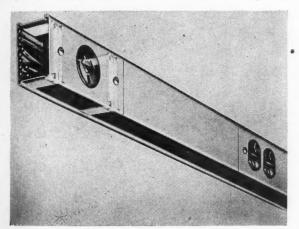
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Surface Raceway

Surfaceduct 1700 is a two piece surface raceway providing a wiring channel service for power, light, heating and other electrical requirements up to and including 60 amp. loads. According to the manufacturer, arch-type bridges within the raceway allow maximum wire capacity, retain the wires during installation, lock the snap-on cover and serve as a method of installing more than 300 approved manufacturers' devices. Four bridges are included with each 10 foot length. The covers are designed to accommodate every approved electrical device and the capping, while securely locked by the bridges, may be easily removed for service additions at any point. Cross sectional dimensions are $2\frac{1}{8}$ by $1\frac{5}{8}$ inches. Along the base $\frac{1}{2}$ and $\frac{3}{4}$ -inch knockout and mounting holes are located every 12 inches. Suspension installations are accomplished by the use of hangers. Its use is further diversified by the availability of side feeds for interconnections to any type of wiring system. Without devices, the duct has an Underwriters Laboratory rated capacity varying from six No. 6 to ten No. 14 wires. National Electric Products Corp., Fulton Bldg., Pittsburgh, Pa.



NATIONAL SURFACEDUCT

Induction Heater

A new portable bench-type induction heater has been developed to meet the need for clean soldering of small parts, and for soldering of metal to metallized glass and ceramics. The coupling link, operating at low impedance, is provided with a grounded center tap. The circuit has been arranged to provide

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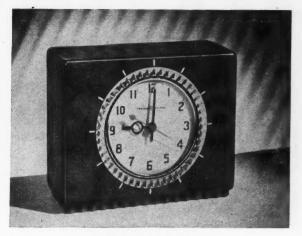
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MARION INDUCTION HEATER

adequate grounding for all elements which might be damaged by arc-over. The rectifier choke and plate current milliammeter are both in the grounded center tap leg of the power transformer, placing them at ground potential. Two switches constitute the controls. One of the switches controls the power to the tube filaments and constitutes a standby switch. The other switch, also mounted on the panel, is the operating switch and controls the high voltages to the tubes. Marion Electrical Instrument Co., Manchester, N. H.



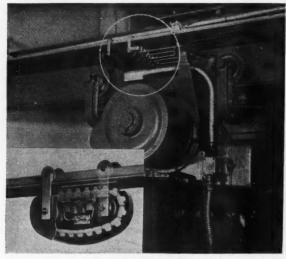
G-E TIME SWITCH CLOCK

Time Switch Clock

Called the Select-O-Switch, this new electric clock turns appliances, rated at 1650 watts or less, on or off for preselected intervals over any 12 hour period. The clock is enclosed in a mottled chestnut plastic case, measuring approximately 6½ inches wide, 5 inches high and 3 inches deep. To operate the time control device, the user plugs the clock into a convenience outlet, then plugs the appliances to be controlled into the outlet in the back of the clock. The appliance is turned on, although it does not actually operate until the clock permits. The clock is self starting, has a sealed-in-oil mechanism and operates on 60 cycle, 110-125 volt a-c. General Electric Company, Bridgeport, Conn.

Rubber Insulated Tractroly

By the use of rubber insulated trolley systems for operating cranes, monorails, portable tools and other mobile equipment, arcing and resultant pitting are prevented. The TracTroly system consists of a copper conductor in standard 10 foot lengths encased in a slotted rubber rack supported by a rigid backing; and individual traveling collectors which employ an endless chain, similar to a tractor tread, to effect positive six tooth multiple contact at all times. Fires, explosions and the possibilities of accidents are reduced to a minimum. Low wear reduces maintenance hours and resultant delays in production. Benbow Manufacturing Co., Hobart Bldg., San Francisco 4, Cal.



BENBOW TRACTROLY

H&H Lock Switches

With CORBIN Pin Tumbler Locks

Keep control of the lighting in proper hands! Guard against unauthorized tampering with lights in schools, hospitals, theatres, auditoriums, hotels or any other building used by the general public.

The Lock Switches pictured here are no ordinary switches with locking device. They're time-tested H & H Rotary Snap Switches, operated only by turning the key in a Corbin Pin Tumbler Lock.

No. 1281 is standard type, single pole, available also in double pole, 3-way and 4-way. No. 1281-WP is weatherproof, with cadmium-finish screw cap plate fitting on a weathertight rubber mat. No. 1291 is a master lock switch, reciprocating type. After inserting key in lock, switch may be turned to right or left — ON or OFF, but key cannot be removed from switch in ON or OFF position. Write for data sheet on this complete line.



DISTRIBUTED THROUGH ELECTRICAL WHOLESALERS

HART & HEGEMAN DIVISION

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U. S. A.

Fluorescent Lamp Diffuser

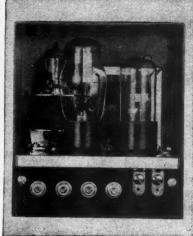
This fluorescent lamp light accessory, known as the Fluor-O-Shield, is for use on all types of open lamp fixtures. It is stamped from one piece of light weight aluminum and finished in white baked enamel. It is easily installed and removed by means of two snap-on clamps. Present models may be installed on any standard 40 watt (48-in.) and 20 watt (24-in.) fluorescent lamps. It casts no shadows but eliminates glare. Camfield Manufacturing Co., Grand Haven, Mich.



CAMFIELD DIFFUSER

Electronic Switch

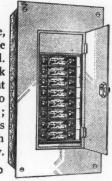
A new electronic switch, Model No. with 8336, safety factor, has been announced. Operating with 30 amps., it can also be used in the presence of explosive gases. It uses a relay with contacts which are hermetically sealed. These switches are used primarily for pressureless limit switching, floatless control of liquid levels and to eliminate contact arcs and welds.



United Cinephone UNITED ELECTRONIC SWITCH Corporation, 65 New Litchfield Street, Torrington, Conn.

Panelboards

Panels are now available in this line, with rugged built-in heavy duty toggle switches for individual circuit control. Features are snap-action, double-break switch with self aligning blade; current carrying parts of extra heavy gauge to carry the full rated 30 ampere current; a toggle switch to stand the off's and on's of daily operation. The Wadsworth Electric Mfg. Co., Inc., Covington, Ky.



WADSWORTH PANELBOARD

Rectifier

A new full wave, copper oxide rectifier, rated at either 12 volts a-c and 50 milliamperes d-c or 6 volts a-c and 100 milliamperes d-c has been added to the line of "Coprox" rectifiers. It mounts on a single screw, is fully enclosed and



sealed with a special plastic compound. Pre-soldered lead wires prevent overheating during assembly. Bradley Laboratories, Inc., 82 Meadow Street, New Haven 10,

Pressure and Deflection Pick-Up

This deflection pick-up is a hermetically sealed electrical unit which translates minute deflections of pressure variations, applied to its plunger, into linear changes in its d-coutput voltage. As its output is 75 millivolts and its internal



STEVENS-ARNOLD PICK-UP

resistance less than 1 ohm, it may be connected directly to standard indicating instruments of a type that are rugged and portable. Several pick-ups may be connected together in parallel. Readings are obtained in the range of 0.0005 inch to 0.1 inch movement of the plunger and response up to 100 cycles per second can be expected. Power supply may be 115 volts a-c or an 8, 12 or 24 volt battery. Results may be recorded on a continuous strip chart. Stevens-Arnold Co., Inc., 22 Elkins Street, South Boston, Mass.

Center-Tap Resistor

This new Type CAM center-tap resistor consists of a core, machined from a solid piece of steatite, upon which is wound a helical resistance wire element. Center and end taps are half-straps se-



TECHTMANN RESISTOR

curely clamped to the core, assuring mechanical rigidity independent of support by the resistance element. The tap assembly employs brass nuts and bolts and stainless steel lock washers. All parts are zinc plated. The CAM resistor is designed on the same principle as the AVW and NC type. Should a unit be overloaded and burn out, the coil can be removed and replaced in a few minutes by removing two nuts. Techtmann Industries, Inc., 828 North Broadway, Milwaukee, 2, Wis.

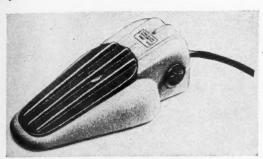


The finest Cast Bronze Bearings for Electric Motor maintenance are now available from stock, carried by Authorized Bunting Distributors throughout the country. Duplicating the original design they fit all popular makes of motors. Factory finished Bronze Bars for your custom made requirements. Ask your Distributor for Catalog. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Branches in Principal Cities.

BUILDE BEARINGS & BUSHINGS & PRECISION BRONZE BARS

Foot Switch

A new Time-O-Lite foot switch for use on drill presses, sanders, lathes, spot welders, jig saws, circular saws or any motor-driven equipment up to one horsepower. A neon pilot light on the foot pedal, inside the switch, shows where the pedal is in the dark. It operates on any accircuit. The switch incorporates a heavy duty snap-action, single pole, double throw switch. Silver contacts are used. Two black outlets, each with 1500 watt capacity, operate electrical equipment when pedal is depressed. One red outlet turns electric equipment off when pedal is depressed. Industrial Timer Corporation, 117 Edison Place, Newark 5, N. J.



INDUSTRIAL FOOT SWITCH

Brush Tension Gauge

A new brush tension gauge for quick and accurate setting of uniform commutator brush spring tension has been announced. It is equipped with a leather strap and hook as a convenient insulated connection between the brush and the gauge. To check and adjust the pressure of a brush, attach the hook to the brush, raise the brush slightly and insert a piece of paper between brush and commutator; pull the gauge upward; when paper can be freely withdrawn the pressure can be read on the gauge and adjusted accordingly. Gauges of two capaci-



NATIONAL GAUGE

ties are available—Model 06-BT, with a range of 0-6 lbs., 2 oz. graduations and Model 009-BT, with a range of 0-10 lbs., and 4 oz. graduations. National Electric Coil Company, 794 Chambers Road, Columbus 16, Ohio.

Radial Cone Loudspeaker

Models RBP-12
and RBP-8 sound
projectors are infinite baffle housings
for cone type loudspeakers designed
for high quality reproduction of music
and speech. The
baffle design provides low frequency response and



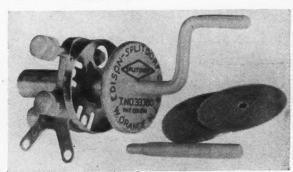
UNIVERSITY LOUDSPEAKER

both speakers are rubber-rim damped to eliminate mechanical resonance. Engineered for 360 degree sound dispersion,

they incorporate construction features that reduce undue sound concentration directly beneath the speaker. Recommended for use in factories, offices, night clubs and other locations where a single speaker is used for complete covererage. Projectors are water-shedding and can be used both for interior and exterior service. The height of RBP-12 is 11 inches with a 27 inch diameter while the corresponding dimensions of the RBP-8 are 9 and 18 inches. University Laboratories, 225 Varick Street, New York 14, N. Y.

Contact Resurfacing Tool

A new mechanical tool for resurfacing all types of contact points and screws used in magnetos, distributors and other electrical units has been announced. The tool consists of a holding ring and revolving resurfacing plate. Old points are held in proper holes in the holding ring by a holding screw. The rotating resurfacing plate, equipped with a special abrasive disk, produces a clean square point. Each tool is equipped with two feeder gauges, two extra abrasive disks, and an electric drill adapter that replaces the handle for power operation. Edison-Splitdorf Corporation, West Orange, N. J.



EDISON-SPLITDORF TOOL

Portable Infra-Red Equipment

Two new types of portable electric infrared equipment have been announced. Model W-6 has a round, all aluminum reflector, 24 inches in diameter. which may be raised or lowered as required. An adjustable arm permits the direction of the reflector over an arc of 180 degrees. It accommodates six lamps. Model R-12, using 12 lamps, is equipped with three toggle switches, permitting the operation of one, two or three rows of four lamps each. The unit is designed to



CARBOMATIC INFRA-RED UNIT

accommodate up to three reflectors, of 12 lamps each, and to enable the user to make banks or tunnels of any design or shape. Both models use 124 or 250 watt size lamps. Carbomatic Corporation, 117 West 63rd Street, New York 23, N. Y.

Alcoa Aluminum Bus Bars

by Aluminum Brackets

• Here's Aluminum's best known property-light weight-employed to full advantage. Bus bars, hangers and housings are all made of Alcoa Aluminum, thereby simplifying installation and reducing the burden on supporting structures.

Of equal importance to the electrical engineer, housings are nonmagnetic and heat is dissipated rapidly. Alcoa Aluminum bus bars have high electrical conductivity.

Indoor or outdoor substation, low capacity or high, Alcoa has the structural materials you'll require. For quotations, call the nearby Alcoa sales office, or write ALUMINUM COMPANY OF AMERICA, 2197 Gulf Bldg., Pittsburgh 19, Pa.

Main generator bus in Jennison Sta-tion, of New York State Electric & Gas Company, Bainbridge, New York.

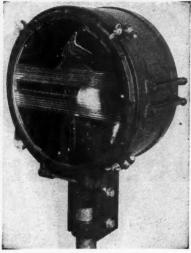
Showing insulators supporting bus at junction box. Bus bars are 31/2" square Alcoa Aluminum tubing.

ALCOA ALUMINUM



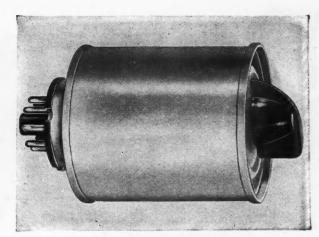
Approach Light for Airports

For use with radio "Blind Landing" systems, a new searchlight type approach light for airports has been announced. It uses a 19-inch reflector lens system with a special 250 watt lamp. The main beam has over one and one quarter million candlepower and is aimed directly along the path of the incoming plane. Mounted in long rows on each side of the approach zone, and spaced 500 feet apart in the rows, the new



WESTINGHOUSE APPROACH LIGHT

lights set up brilliant walls of light on each side of the approaching plane. As each approach light has about the same candle power as an airway beacon, the 2500 foot rows of light provide over a half mile of direct visibility in the "soupiest" weather. Westinghouse Electric Corporation, Pittsburgh 30, Pa.



ECI INTERRUPTER

small power relay and a resistor when required, to properly apportion the flow of current between the thermal element and the relay coil. It can be supplied with a fixed, predetermined rate of interruption or with an external variable adjustment. The fixed unit can be supplied in either open frame construction or in plug-in metal enclosures—dust cover or hermetically sealed. The adjustable unit is available in plug-in dust cover enclosures only. It operates on 32 volts d-c and 125 volts, 60 cycles a-c. It is recommended for warning signals, flasher lights, industrial controls, life testing circuits and process timing. Electronic Controls, Inc., 44 Summer Ave., Newark 4, N. J.

Temperature Control

A new line of adjustable calibrated Cam-Stat temperature controls has been announced. Some of the advantages claimed are precise dial selection of the temperature control point with uniformity of dial accuracy in all units; no increase in space required for mountings or in cost over other thermostats without calibrating dial; tamperproof dial installation preventing changing of adjustable range pro-



CAM-STAT CONTROL

vided at the factory and a ready adaptability to specially styled adjusting knobs and other design requirements. A wide choice of adjustable ranges is also available between minus 50 degrees and plus 600 degrees F., with differentials as low as 1 degree F. The Cam-Stat may be clamped on the tank or the element may be immersed in water. It has double break snap action contacts with a rating of 12 amperes, 115 volts a-c or 28 volts d-c, available in S.P.S.T., S.P.D.T. or S.P.D.T.-independent circuit. Paul Henry Company, 2037 South La Cienga, Los Angeles 34, Calif.

Spot Welding Machine

A new portable spot welding machine has been announced. To the cabinet is connected a pair of insulated, forged copper tweezers and a foot switch. It plugs into 115 volt, 60 cycle power supply and may be adapted to 200 volt. With the use of the tweezers, the electrodes may be applied directly to the tiny parts to be joined. It probes for the parts, holds and bends them, and welds. The tweezer leads are flexible, plastic covered and 18 inches long. The tweezer tips may be shaped or filed to accommodate oddly formed parts. Where more pressure is required, the tweezers may be removed and the machine connected to a drill press or hand arbor. Copper or copper alloy rods may be inserted as electrodes with only the bottom electrode insulated. Tweezer-Weld Corporation, 280 Plane Street, Newark 2, N. J.

TWEEZER SPOT WELDING MACHINE

Self-Timing Interrupter

This new self-timing interrupter unit is comprised of a glass-enclosed thermal element of the hot-wire type, a

REPCOCLET Underfloor Duet System

A recent installation at the Carnegie, Pa., branch of Joseph T. Ryerson & Son, Inc.

National NEPCODUCT
for underfloor power and
communications wiring offers
the following features:

- Ready access for outlets
- Outlets of adjustable height
- Saddle supports
 level the duct
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PRODUCTS CORPORATION Pittsburgh 22, R.

Complete engineering data on request

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New York Board of Fire Underwriters

New York, N. Y.

QUESTIONS ON THE CODE

LIGHTING FIXTURE IN GRAIN ELEVATOR

Q. Is it true that a lighting fixture approved for a Class 1 Group D location cannot be used in a grain elevator?—E.S.

A lighting fixture might be ap-A. proved for both a Class 1 Group D and a Class II Group G location, but if the approval label states that the fixture is approved only for use in a Class 1 Group D location it should not be used in a dusty location. The reasoning behind the requirement is based upon the ability of fixtures to dissipate heat. A device suitable for use in a Class II location must be able to operate when covered by a heavy layer of dust without raising the temperature of the dust blanket to or near its ignition point. Obviously this heat dissipation problem is not present in an atmosphere which contains explosive vapors or gasses, so a device suitable for a Class 1 location is not necessarily safe for use in a Class II location.-G.R.

MASTER FARM SERVICE

A Utility serves a farm customer at a (more or less) central pole, owned by the customer, from which he has installed overhead conductors to various farm buildings. The Utility requires him to provide metering facilities at the pole with fused, externally operable switch and equipment and neutral grounds". Each set of overhead conductors to the various buildings is to be of sufficient capacity to carry the load at each building, but each set is not the same size wire. Each building to be supplied will have a "Service Entrance" installed to comply with code requirements for service entrances.

To comply with the code, would each set of "Service Drops" require individual protection at the pole? Would any fuse or breaker protection be required at the pole?—L.A.W.

A Section 2405 requires that an over-current device shall be placed in each ungrounded conductor and Section 2434 requires that these devices shall be located at the point where the conductor receives its supply.

We must also keep in mind that where a master service is involved, as at farm occupancies, Section 2306 states that the conductors running from one building to another, shall not be considered as service conductors. Therefore the Code seems to require that where master service equipment is placed on a pole serving farm buildings and where the conductors to the various buildings are only "of sufficient capacity to carry the load at each building" and are therefore not of a size to be protected by the service protective device on the pole, they shall each be protected by proper capacity protective devices.

This of course, means a set of fuses or circuit breakers in a cabinet installed

Back in the electrical contracting business again after three years absence is Arthur H. Oksendahl of Rugby, N. D. Art went into the U. S. A.A.F. in 1942 as a turret and gunsight maintenance man in a B-17 heavy bombardment squadron. A year later he was released as an essential worker to build REA high lines. Before re-opening his own business in the fall of this year, he was instructing Navy electrician's mates at the North Dakota State School of Science at Wahpeton.

on the pole or in a building near the pole. Such an arrangement may be far from satisfactory after a short time if the maintenance is not good.

It seems to this writer that a better arrangement could be made even though it might stretch some of the Code rules.

Our inquirer states that the Utility requires metering and service equipment to be installed on the pole. All right, let's put it there and have it of sufficient capacity to carry the entire load. The service switch would provide one master point of control and the protective devices would provide a great deal of safety, certainly much more safety than if there was no service equipment on the pole.

Then let's use conductors to the various buildings of such capacities as will be provided with short circuit protection by the service protective devices, say one-third or one-quarter the capacity of the service protective devices but in no case less than No. 8.

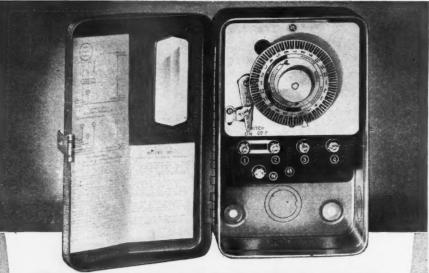
Then, treating these conductors to the various buildings as service conductors, let's provide service equipment at each individual building.

This arrangement would certainly be better than having "hot" unprotected and uncontrollable wires running around the farm yard with only a primary fuse for protection and it avoids placing fuses out in the weather, even though they may be housed in a cabinet.—

OVERCURRENT PROTECTION

The main service switch is rated at 100 amperes and from this I plan to extend two sets of feeders. One set will consist of three No. 6 conductors which will run 50 feet from the service switch to a panel and the other set will be three No. 8 conductors that will extend about 20 feet to a panel. Will I have to provide fuses for these feeders at the service equipment, or may they be considered protected by fuses at their respective panels?—T.H.P.

- 19. gerr



The TOP VALUE in Time Switches

Paragon
300
SERIES
Now
\$1075

Telechrone MOTORED OPERATING ADVANTAGES

- Self-starting synchronous operation.
- 2 Complete, self-oiling lubrication by patented capillary oiling system.
- 3 Years of continuous and uninterrupted operation.
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Make bigger profits . . . reduce your service time on completed installations and build good will for your business . . . by using Telechron motored Paragon 300 series Time Switches on all installations of signs, commercial lights, windowlighting displays and other phases of electrical advertising.

Increased volume and manufacturing efficiencies learned during the war permits a price reduction to \$10.75 list on this service-proved . . . precision . . . quality ON and OFF time switch. Now includes many improvements, one of which is the Telechron motor. Easy to install and set. Requires practically no service. Positively not affected by dust. Highest type of design and construction.

Offered by progressive sign and electrical supply jobbers at generous trade discount. Write for complete bulletin. Available in SPST, SPDT, DPST at slightly increased prices.



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PARAGON ELECTRIC COMPANY
710 OLD COLONY BUILDING
CHICAGO 5, ILLINOIS



The answer to your question is found under Section 2434. The first sentence of this section is as follows: "Overcurrent devices shall be located at the point where the conductor to be protected receives its supply, except as follows:" Then under 2434-d we find the exception which covers your problem. This paragraph contains the following provisions: "If the smaller conductors have a current carrying capacity at least one-third that of the conductor from which they are supplied, and provided the tap is suitably protected from mechanical injury, is not over 25 feet long, and terminates in a single circuit-breaker or set of fuses which will limit the load on the tap to that allowed by Tables 1 and 2, Chapter 10. Beyond this point the conductors may supply any number of circuit-breakers or sets of fuses." In your case the shorter set of feeders would be permitted by this exception in the Code, but the longer set would have to be provided with overcurrent protection at the service equipment.

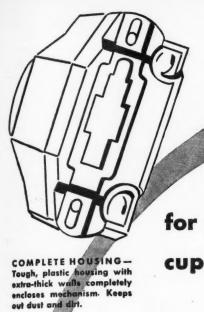
MOTOR CIRCUIT AND CONTROL WIRES IN SAME RACEWAY

"Does the Electrical Code permit motor wires and control wires such as for Stop and Start buttons and any other automatic control, in the same conduit, for the same motor they control and also control wires for different motors? Where will I be able to find this in the Code book?"—G.K.

Yes. The Code permits both the motor circuit and the motor control conductors to be run through the same raceway system including conduits, boxes, etc. This will be found in the second sentence of Section 3013 of the Code and also in the fine print note under Table 9, in which it is stated that if more than nine wires are needed between



"When can we get it?", asks Carl A. Wild (left), Wild Electric, Milton, North Dakota. J. L. Kertz, Reinhard Brothers, Fargo wholesalers, seems to be pondering the answer at recent Fargo meeting of North Dakota Electrical Contractors Association.



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DURABLE MECHANISM—A rugged mechanism and impact resisting molded plastic handle assure dependability under severe usage.

for heavy-duty, shallow cup requirements

YOKE—Integral plaster ears assure proper alignment flush with wall surface or can be broken off easily if not desired. Insulated from mechanism.

USE THE BRYANT
5861
LINE OF SWITCHES

Bryant 5861 switches are built for heavy duty service in commercial and industrial installations where higher-than-usual loads are encountered. Shallow cups (only 1½" deep) permit easy installation in conventional switch boxes. A rugged meclanism insures trouble-free service. "T" rated at 20 amps, 250 volts, they conform to Federal Specifications.

Available in single-pole, double-pole, three-way and fourway types with brown or ivory handles and lock-type or momentary contact mechanisms.

> EASY WIRING—Top wired. Large, well-recessed binding screws make wiring easy.



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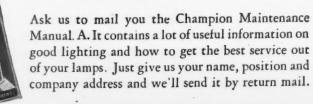


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Champion Lamps are made and tested to provide the most efficient, low cost industrial light Back of them is an organization of specialists in industrial lamp manufacture and application, with trained lighting experts in the field to give you dependable, unbiased counsel on correct lighting for every part of your plant.

It will pay you to standardize on Champion Lamps and get them from the local Champion distributor.

May we put you in touch with him?





a motor and a controller, they may all be placed within the same conduit.

If the control wires of more than one motor exceed nine, then they should not be run in the same conduit.—F.N.M.S.

REWIRING A DEPARTMENT STORE

We are rewiring a fair size department store and are required to pull new feeders from the basement to fourth floor and provide 90 circuits on each floor. Due to remodeling, it is impossible to bring these new feeders up through the building in the space formerly used, so it will be approximately 25 feet from the proposed site of the new panelboards to the location of the existing distribution cabinets. Now our question is this, can we place panels on each floor where the proposed feeders will be run and extend a wireway from the proposed panel to the existing cabinets and place in each wireway a single neutral of sufficient size to handle maximum unbalance of load and about half of the ungrounded circuit conductors, then we would place a neutral bus in the existing distribution cabinet and pick up the individual grounded conductors at that point.—E.D.

This question can best be A. answered by quoting various sections of the Code which would be in conflict with such an installation. First Section 3881 limits any panelboard to 42 circuits where one overcurrent device per circuit is used or to 20 circuits where two overcurrent devices are used for each circuit. Second, Section 3624 limits the number of conductors within a wireway to 30 unless the conductors are for signal or control circuits. Third, Section 2104 requires that the ungrounded conductors of a multi-wire branch circuit have a potential difference between each other.-G.R.



J. S. Fly (left), WESCO, Fargo, N. D., gives P. A. Tangen, Pekin Farm Electric, Pekin, N. D., some idea as to availability of farm wiring materials and appliances.

POINTS IN WIRING ON WHICH YOU CAN BUILD PRESTIGE AND

PORCELAIN PROTECTED WIRING SYSTEMS

1-ADEQUATE 2-SAFE **3-PERMANENT** 4-FLEXIBLE 5-ECONOMICAL

Macomb. III.

ADEQUATE — has higher current carrying capacity. Home owners don't suffer the inconvenience and inefficiency of overloaded circuits and too few convenience outlets.

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FLEXIBLE — easy to extend systems and add circuits. Open feeders in basement are easily accessible.

ECONOMICAL — adaptable to practically all wiring plans and layouts. In all wiring, adequacy can be obtained at low cost. Time is saved in making installations. Customer benefits through savings contractor makes and also because of the permanency, adequacy, and safety of porcelain.

* ILLINOIS ELECTRIC PORCELAIN CO.

* PORCELAIN PRODUCTS, INCORPORATED Findlay, Ohio

*SPECIALTY PORCELAIN WORKS *SUPERIOR PORCELAIN COMPANY

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MODERN PORCELAIN PROTECTED WIRING SYSTEMS

FOR FOOL-PROOF SAFETY EVERY TIME IN CUTTING MOTORS FROM THE LINE, THIS FEDERAL RELAY DOES THE TRICK WITH THOSE WHO KNOW-IT'S BOUND TO CLICK!



STANDARD EQUIPMENT



MAGNETIC MOTOR STARTERS

Wherever overload protection is needed . . . whether on new or existing installations . . . Federal's Overload Relays will provide the "plus-margin" of dependability generally associated with Federal products. Naturally, these relays are built into Federal Noark Magnetic Starters ... but remember, too, that they're available for your special applications. Federal Overload Relays provide conveniently located load and control circuit terminals, often making additional terminal blocks unnecessary.



FEDERAL ELECTRIC PRODUCTS COMPANY, INC. EXECUTIVE OFFICES: 50 PARIS ST., NEWARK 5, N. J. . PLANTS: HARTFORD, CONN. . NEWARK, N. J.

FIXTURES FOR HAZARDOUS LOCATIONS

In a recent issue it was stated that one manufacturer had obtained an Underwriters' approval of a lighting fixture for use in Class 1, Group A locations. In this plant we have Class 1 Group A locations. Could I get in. formation on this fixture? - O.E.K.

We do not find any listing of A. lighting fixtures for use in Class 1 Groups A or B. Several manufacturers have fixtures listed for Class 1 Groups T and D, and for Class II Broups E, F and G. Some are for incandescent and some for fluorescent lighting.-F.N.M.S.

TYPE S CORDS FOR PORTABLE LAMPS

"I have used ordinary type S flexible cords for portable lamps of the Class I explosion-proof type on several installations and have considered it acceptable to the Code. Now, however, I have been told that lamps of this type must be connected by a three conductor cord. Is this a Code requirement?"-O.C.S.

The Code accepts the use of a A. type S cord, but it must contain grounding conductor which must ground the guard housing. If you will refer to section 5022 of the N. E. Code you will find this ruling.—G.R.



Evert Kincaid, executive director, The Chicago Plan Commission, tells the Illinois Chapter, IAEI of the need for improvement to assure future growth of the city. Particular emphasis was placed on housing plans.

GROUNDING CONDUCTOR

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In our territory the utility requires that a ground wire be dropped from the neutral at the service pothead on a building service to a ground rod. Now, may I bring the grounding conductor out from the service equipment and attach it to this grounding wire leading from the service pothead to the ground rod, or may the grounding conductor between the service equipment and the ground rod be omitted entirely inasmuch as there would be a path to ground via the neutral conductor in the service raceway or cable to the pothead and then to ground on the special utility grounding wire?-J.T.

This is a rather controversial A. question as it is apparently pointed at the R.E.A. specifications. However, the N. E. Code contains the following requirements. Section 2591 we find the following sentence: "Except in cases of busbars, the grounding conductor shall be without joint or splice throughout its length." Then under Section 2521: "The grounding of wiring systems, circuits, equipment, arresters, cable armor, conduit and other metal raceways as a protective measure shall be so arranged that there will be no objectionable passage of current over the grounding conductors. The temporary currents set up under accidental conditions, while the grounding conductors are performing their intended protective functions, are not to be considered as objectionable."

It would therefore be necessary to run a continuous grounding conductor from the service equipment to the ground rod or grounding electrode used. Technically the Code would prohibit the grounding conductor being attached to the utility grounding wire, and if your alternate suggestion were followed the path to ground would not only contain splices but also would conduct current as the neutral would carry all unbalanced load currents.—G.R.

INTERIM AMENDMENT NO. 50

Q. Will you please advise me if there has been any change in Table 4 of the Code as revised by Interim Amendment No. 50?—R.C.

There has been no change to Table 4 of the Code except the war emergency revision of Interim Amendment No. 50, which will cease to be in force on the effective date of the 1946 Code which it is expected will be November 1st, 1946. The 1946 Code





EVER-LOK AUTOMATIC LOCKING RECEPTACLES, CONNECTORS & PLUGS

Where uninterrupted service is vital, Ever-Lok connectors insure against faulty contacts, vibration and accidental separation. They are the preferred standard for the connection of high cycle tools and portable equipment.

Locking is automatic and positive. Plugs cannot be inserted the wrong way. Steel clad, dust-proof, self-wiping and self-aligning contacts and positive grounding.

EVER-LOK is made in 2, 3, and 4 pole, 10 to 200 amperes and 2 to 11 pole for signal and control service.

Available in the form of receptacles and plugs for outlet and conduit boxes, surface and gang types, reverse and multiple circuit, weathertight and for cord connectors and also many special modifications not listed in the R. & S. catalog.



2-wire 3 pole EVER-

LOK with midget or

Busman fuses.

EVER-LOK receptacles, also available in gang type.



Table No. 4 will be the same as the original Table No. 4 in the 1940 Code.—F.N.M.S.

THREE-WAY SWITCHING

I am wiring a large store room in which the ceiling and receptacles consist of twelve circuits and controlled from twelve 3-way switches in two panels.

My intention was to install four $1_{\frac{1}{4}}$ -in, conduits between these panels containing nine No. 12 conductors in each.

I was instructed to install a 2½-in. conduit to carry all 36 conductors which I think is contrary to the Code as these conductors are not classed as control circuits and are part of the lighting system and carry current.

According to Chapter 37 Table 5 of Abbott's Guide, more than nine conductors are permitted in a single conduit for motor control circuits, stage pocket and border circuits, sign circuits, elevator control circuits, and signal and control circuits.

I was a former electrical inspector and I think I am right in installing four 1\(\frac{1}{4}\)-in. conduits instead of a single conduit. Am I correct?—L.J.E.

Of the three wires running between the two "three-way" switches of each circuit, only two are carrying current at the same time. Therefore heat would be produced in only two of them. It would therefore be permissible to count each three wires as two. Then, as we could take care of four 2-wire circuits (equivalent to light wires) in one conduit, we could use three conduits for the 12 circuits, placing twelve No. 12 wires in a 14-in. conduit.

The Code certainly would neither require nor permit all of the 36 wires to be run in one conduit.—F.N.M.S.



Chicago electrical inspectors Edward Hogan (left) and Harry Hayman in an anteroom huddle during recent Chicago conference of the Illinois Chapter, IAEI.

SO QUIET- (More than ever)



Quiet as a breath would aptly describe Jefferson Electric Ballasts. This is a quality made possible by advanced engineering technique combined with perfected large scale manufacturing methods. Correctness of ballast design and uniform construction are other natural results of the research, specialized experience, and material control that characterizes Jefferson production.

Specify Jefferson Ballasts for your fluorescent lamp installations and be assured of better lighting performance. Secure complete engineering data by writing for Bulletin 441-FL. JEFFERSON ELECTRIC COMPANY, Bellwood (Chicago Suburb), Illinois. *In Canada:* Canadian Jefferson Electric Co., Ltd., 384 Pape Avenue, Toronto, Ont.



BALLASTS

HOT CATHODE BALLASTS

The complete line of Jefferson Ballasts includes capacities and types for all commercially made fluorescent lamps.



END OR BOTTOM LEADS

Jefferson Ballasts are now available in two-lamp 40-watt sizes, designed to bring leads either from ends or bottom.



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This Jefferson Ballast operates two eight-foot cold cathode lamps.

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The importance of Electronic Induction Heating to the metal-working and metal-processing industries lies in its ability to handle heattreating jobs faster, more efficiently and with greater precision than other methods—and usually at lower cost. Such equipment, using RCA Electron Tubes like the one illustrated, has the following advantages: Speed: The work piece can be made to absorb efficiently as much as 5000 B.T.U.'s per square inch of area, per minute—17 times the top figure for heat-transfer systems.

Control: Through the proper selection of power input, frequency and timing, and by energy concentration, heating depth can be precisely controlled in surface-hardening and other heating operations.

Concentration: The heating power induced in the work piece is derived from a coil that can be shaped to the work. Full power is concentrated on the area under treatment. Accessibility: Surfaces ordinarily inaccessible to heat-transfer systems are readily heat-treated by the use of work coils shaped to interior or exterior dimensions.

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Get the Facts: It will pay you to review the possibilities of Electronic Induction Heating now. We shall be pleased to place you in touch with reliable manufacturers who can show you how it is solving many ticklish problems in the metal industries. Just write RCA, Commercial Engineering Department, Section I-8C, Harrison, N. J.

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PRACTICAL ARTICLES on the application, installation and maintenance of electronic apparatus in industry. Readers are invited to contribute items from their experience to this department. Articles used will be paid for.

ELECTRONICS

THE SERVO SYSTEM-PART II

If the system is made to work as a transformer, as shown in Fig. 7 the rotor voltage will be at a maximum when their windings are aligned. If the rotor is moved as shown in Fig. 8, the rotor output voltage will be zero. This has a 180° ambiguity if only voltage is considered, for the voltmeters used are seldom phase-sensitive. If a three-winding stator is used, as in Fig. 9, it is obvious that the voltage across each of the coils is a function of the coupling between that coil and the rotor. The coupling will change for

FIG. 9

FIG. 8

FIG. 8

FIG. 9

FIG. 8

FIG. 9

FIG. 8

George O. Smith

each position of the rotor, inducing a different voltage across the coils.

This is a synchro generator. If this is connected as shown in Fig. 10, the rotors will tend to line up with their respective stators so that the angle in G will be equal to the angle in M. Turning either rotor changes the coupling of that rotor to its stator, causing a shift in the current through the stators of the other synchro. Since the rotors are energized from the line, the shift in magnetic field causes the other rotor to move so that its own magnetic field aligns with the stator field. This is a simple synchro-system. The only difference between generator and motor is the inclusion of a damper in the motor to keep the shaft from "dancing" due to the a-c in the coils. The generator is usually turned by a heavy rotating member which effectively damps any unwanted oscillations. The motor, on the other hand, in a simple system never turns more than a light indicating dial and requires inertia damping.

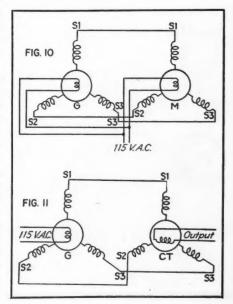
The simple system does not produce much torque, since the misalignment of the rotors produces a magnetic urge proportional to the deviation. When torque is needed, a control transformer and control rectifier drives a motor to produce whatever torque is needed.

As shown in Fig. 7 and Fig. 8, the position of the rotor will dictate the voltage across the stator coils. Now if the motor rotor is not connected to the supply line, but to a sensitive voltmeter instead, the inter-action between generator and motor does not exist. When the shafts are aligned as shown in Fig. 10, but with the rotor disconnected, a maximum voltage will be found across

the motor rotor. Turning this rotor 90° will reduce the voltage across it to zero. Turning the generator shaft will change this again, and the new zero-position of the motor shaft will be found 90° from the new position of the generator shaft.

Motor and generator are alike electrically, and the control transformer differs from either only in the rotor winding. Since it is not intended to drive, the control transformer winding is made of many turns of fine wire so that the voltage set-up from stator coils to rotor coil will result in the maximum voltage across the rotor. The zero-angle of the control transformer is also measured from a 90° angle with the rotor. All synchros are measured in terms of the angle between the rotor shaft and the stator coil S1.

When the shaft of the generator sends forth data that disagrees with the posi-



Electrical Contracting, March 1946



CRESCORD comprises two, three or four flexible copper conductors, with color-coded, heat-resisting, rubber insulation under a tough, synthetic rubber jacket. It is flexible, highly resistant to a brasion, crushing, cutting, water, weather and sunlight.

Type S. CRESCORD has a heavy jacket for maximum life on portable drills, tools and industrial equipment.

Type SJ CRESCORD has a lighter jacket for use on household and office appliances. It is made in sizes No. 18 and No. 16 AWG only.

Type SV CRESCORD is a small, light, extremely flexible cord for use on household vacuum cleaners. It is made in Size No. 18 AWG only.





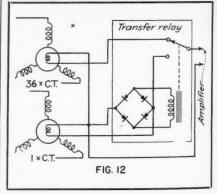
CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, N. J.

tion of the control transformer, the voltage difference on the rotor of the latter is introduced to an amplifier. Since this control transformer voltage output is again proportional to the angle of deviation, dropping in a smooth curve to zero as the agreement is reached, the voltage is amplified in a high-gain stage so that minute voltages appear strong. The output from the voltage amplifier controls the operation of high-current thyratrons, the output of which runs the drive motor until the system is in agreement.

Since the control transformer is not phase sensitive, the amplifier is made so that the input from the control transformer is compared to the supply line from which the generator rotor is driven. This eliminates the 180° ambiguity; also permits the use of a pushpull amplifier that will drive the motor in whatever direction is needed to satisfy the agreement between generator and control transformer.

If greater accuracy is required, a second generator may be geared down from the driven mechanism, and working in reference to a second control transformer geared identically to the first. If extreme precision is needed, a third generator and control transformer system may be still high in gear ratio. When this is done, the high-geared system will produce several ambiguities, one for each gear-ratio.



However this is eliminated by the use of a small relay and rectifier across the low-speed control transformer. When the disagreement between generator and control transformer in the 36X system exceeds the ambiguous level, the voltage across the 1X system control transformer is sufficiently high to cause operation of the relay, thus switching the control amplifier and rectifier over to the 1X system. The motor then turns the mechanism to within the limit of the 1X accuracy, at which point the voltage across the control transformer is lowered to the relay "drop-out" point and the positioning system then continues on a 36:1 accuracy basis. Another set of generator, control transformer, and transfer relay would permit gearing to better than 1000:1 accuracy. This

why Certified Ballasts

spell Customer Benefits



PLUORESCENT fixtures equipped with Certified Ballasts can do a lot to build customer good will. Because they mean satisfactory performance longer . . . fewer service troubles . . . better lamp operation.

Here's why:

- 1. Certified Ballasts are quality built ... made to specifications set up by foremost lighting engineers . . . to assure better lamp performance.
- 2. Certified Ballasts are E.T.L. checked. Sample ballasts are thoroughly tested by famous Electrical Testing Laboratories, Inc., before they are certified as meeting Ballasts specifications. Random samples are periodically rechecked at the Laboratory and at the factories.
- 3. Certified Ballasts help assure top performance in fluorescent lighting units that use them. Leading fluorescent tube manufacturers recognize this-since with Certified Ballasts in a fixture, they will guarantee lamp performance.

Whether it's in a new fluorescent fixture or for replacement in existing equipment, the customer's interests . . . and yours . . . are best served by Certified Ballasts.

Certified Ballast Manufacturers

Makers of Certified Ballasts for Fluorescent Lighting Fixtures

CHICAGO TRANSFORMER CORP. 3501 Addison St., Chicago, Illinois

GENERAL ELECTRIC CO. **Specialty Transformer Section** 1635 Broadway, Fort Wayne, Ind.

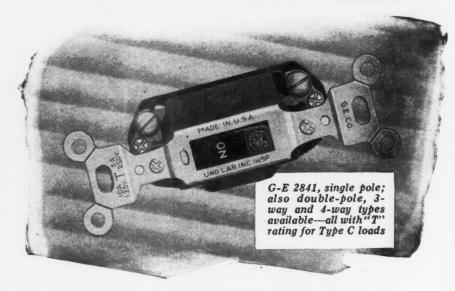
JEFFERSON ELECTRIC CO. Bellwood, Illinois

SOLA ELECTRIC CO. 2525 Clybourn Ave., Chicago 14, Illinois

WHEELER INSULATED WIRE CO. 378 Washington Ave., Bridgeport, Conn. SPEC. NO. 6

HIGH PF

USE G-E HIGH QUALITY STANDARD SWITCHES



Here are dependable switches that will fill all your needs—designed for easy installation and long service. These switches are completely insulated with Textolite. They have many features that will interest you. Look at the following list.

Notable Features

- 1. The box is made of Textolite. Strong without bulk. It is narrow and shallow to allow a maximum amount of wire room. Resists oil and moisture.
- **2.** Blades are securely anchored in Textolite blade carriers giving permanent alignment. Construction is simplified. There are no washers to absorb moisture.
- **3.** Contacts are correctly positioned by the box. Dust cover fastened to stay in place.
- **4.** Large binding screws for top wiring accommodate No. 12 wire.
- **5.** Cross bar is securely fastened to box and has wide mounting ears. Provides correct alignment. Ears are washer type and can be broken off to bush up switch when necessary.

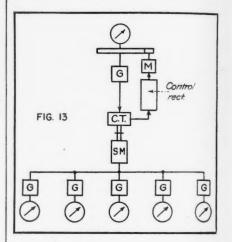
These high quality switches are neat in appearance, light in weight and highly resistant to breakage. They are available with brown or ivory-colored handles.

For further information see the nearest G-E Merchandise Distributor or write to Section D361-8, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL & ELECTRIC

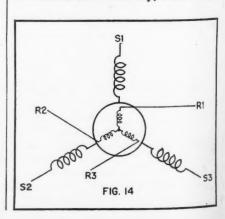
accuracy is not absolute accuracy, but is a matter of 1000:1 times as accurate as the single speed system which will position mechanisms to better than one degree error between the setting of the control transformer and the generator.

A multiple-control system becomes somewhat more complex. To control the mechanism from several stations, the simple connection between control transformer and the setting dial must be augmented. The control transformer is driven by a synchro motor, which is in turn driven in synchronization with the remote generators. This is shown diagrammatically in Fig. 13. Since gen-



erators and motors are all electrically alike, turning any one of them causes the rest to turn in sympathy. The synchro-motor (SM) turns the control transformer and the servo system takes over from there. The instantaneous position of the mechanism may be read from any position since they all follow the one that was turned. A multi-speed system requires that the synchro equipment be duplicated for each position.

The final member of the synchro family is the differential generator. The difference between the differential generator and the motor, control transformer, and generator is that the differential has a three-winding rotor. This is diagrammed in Fig. 14. It introduces a differential in the system. If, for instance, the generator and differential are moved simultaneously, their differ-







THE ACME ELECTRIC AND MANUFACTURING CO.

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ON FLUORESCENT LAMP BALLASTS

• A buyer's confidence in a product is often won by his familiarity with the labels it bears—because he recognizes the trade mark of an organization long established in its particular field.

Thus, ballasts bearing the Chicago Transformer trade mark of manufucturing experience, Plus the seals of two recognized testing laboratories, do much to win confidence for the fluorescent lighting equipment in which they are installed.

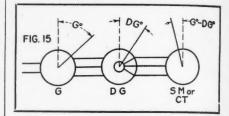
C.T.C.—manufactured by Chicago Transformer
E.T.L.—Certified by Electrical Testing Laboratories
U.L.—Approved by Underwriters Laboratories

... the three labels to look for on Fluorescent lamp ballasts

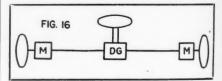


ence would be zero, and the motor then would not move. If the generator is not moved and the differential is turned, the motor moves so that the angle of the generator minus the angle of the differential equals the angle of the motor.

The operation of the differential is due to the three-pole rotor. These, in the zero position, match one rotor coil to each stator coil, producing a one-to-one ratio through the differential which makes the electrical transer appear as though the differential were not in the



circuit between motor and generator. If the differential is turned, however, part of the coupling is changed so that each stator couples to more or less of two rotor coils. This changes the relationship between the voltages along the generator output so that it appears to the motor as though the generator were turned by a corresponding angle. In effect, the differential acts in much the same way as the differential gearing on an automobile, with the difference that electrical wiring replaces the shafts as in Fig. 16.



Additional refinements and complexities exist, the limit of the arrangements and possibilities of combining the elements of the synchro family is far beyond any discussion. Whether positioning overhead cranes or cutting complex castings from a master pattern, the synchro and the servo system is efficient and accurate.



Prosperity smiles depict rural farm wiring market thoughts of North Dakota electrical contractors (L to R) A. V. DuVall, DuVall Electric Co. New Rockford; Walter Goss, Goss Electric, Hunter; and H. K. Junge, Junge Electric, West Fargo.

Electrical Contracting, March 1946





Here's engineering you'd hardly expect in moderately priced door chimes! Standard on six NuTone models, this power-unit innovation on which U. S. and foreign patents are pending offers you these exclusive advantages:

SELF-CONTAINED—no parts to go astray, an integral unit that's "all there"—all the time!

COMPLETELY SEALED—prevents entrance of dirt and dust into moving parts, the greatest single cause of operating failure.

EASILY REMOVABLE—loosen two screws and unit lifts off—chime stays on wall. Easy to service although the need for repair is unlikely... the unit on test having been operated perfectly 392,000 times—almost 180 years of average, six-time-a-day home use!

Precision-made, long-lasting, easy-to-service NuTone Chimes cost you less in the long run, are the kind most people want. Write today for full information. Address your nearest NuTone office. NuTone, Incorporated, Merchandise Mart, Chicago 54, Ill.; 200 Fifth Ave., New York 10, N. Y., or 931 East 31st St., Los Angeles 11, Calif.



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STYLED TO SUIT any type of interior construction and finish. Models range from sleek ultra-modern to classic period designs.



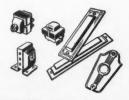
BUILT TO LAST, the door chimes you can install and forget. Precision-built, enclosed working parts, sturdy chassis, lifetime plastic, brass, and steel exteriors.



EASY TO INSTALL—a screwdriver job that's done in a jiffy. Especially if you provide for the chime in your general wiring scheme.



WIDE CHOICE OF MODELS to suit every taste. Variety of styles, shapes, and sizes from small kitchen chime listing at \$2.95 to elegant, hall-clock-chime combinations at \$49.95.



TRANSFORMERS AND PUSH BUTTONS, TOO. NuTone offers you the whole door-chime "package." Three types of 10-volt transformers; four new push buttons—round and piano-key types.



WORLD'S LARGEST MAKER OF DOOR CHIMES



ONE "Clock Watcher" THAT BUYERS OF LIGHTING BUSTNESS

IT'S PROFITABLE TO SELL

-SYNCHRONOUS MOTORS SILVER CONTACTS

Whether it's utility lighting, advertising lighting, or a protective lighting installation, each has a definite purpose for a definite time—and it's important that the "on" and "off" time be accurate.

You can sell this accuracy with AUTO-MATIC CONTROL for every lighting job. The men who invest in lighting installations see that in eliminating the human element and installing SANGAMO TIME SWITCHES they gain dependable control.

Write for our catalog — it'll give you full details.

Six levers are provided for a maximum of 3 daily "on" and "off" operations. Accurate timing is obtained by turning the minute hand reset staff on the 24 hour dial. If desired the time-switch can be manually operated without affecting subsequent operations. Available in a wide variety of combinations providing two-circuits, duplex, and outdoor switches; also with Sunday and holiday omitting device, as well as advance time cutoff. The KAZ Astronomic Dial Time-Switch functions to close the circuit at sunset and open it at sunrise, or the "off" operation may be set at any time between 9:30 P.M. and 2:15 A.M.

FORM VSWZ SYNCHRONOUS MOTOR WITH CARRYOVER

Synchronous timing is combined with reserve spring clock operation, providing continuous operation during current inter-ruptions up to ten hours. This entirely automatic carry-over eliminates the necessity of re-setting the dial after current interruptions, and insures accurate timing under all conditions. Equipped with Astronomic Dial.





ASTRONOMIC DIAL: Both of the Sangamo Time Switches shown here are equipped with Astronomic Dials. These dials enable "on" and "off" operations in accordance with sunset and sunrise.

SANGAMO ELECTRIC COMPANY SPRINGFIELD

IN THE NEWS

SURVEY SHOWS MANUFACTURERS NEED PRICE INCREASES

The electrical manufacturing industry will require substantial price relief under the provisions of the administration's new wage-price policy. First replies to a questionnaire distributed to the industry by *Electrical Contracting* reveal that producers cannot absorb the large increase in wage and material costs stemming from the new policy without prices higher than those prevailing in early 1941. The same manufacturers feel that if they are to meet the terms of the President's recent executive order, further wage increases are inevitable.

Immediately upon announcement of the new wage-price policy, *Electrical Contracting* wired a series of questions to manufacturers of electrical products in order to determine its effect of the policy on the industry. When completed, the inquiry will disclose the increase in cost of labor and materials since the start of 1941, the extent to which producers estimate costs must still advance as a result of the administration's efforts to raise the general wage level, and the magnitude of the price increase required to assure even the low minimum profit

rate permitted under price control.

Replies to the survey have started to pour in, and the nature and magnitude of the serious pricing problem facing the industry is already clear. Hourly labor costs have risen anywhere from 15 to 65 percent. Moreover, the cost of materials has climbed steadily upward, again largely the result of the general wage advance throughout the economy. In some instances, material costs have jumped as much as a third, although an advance of around 15 percent apppears to be more typical.

In the face of these higher costs, prices of most electrical goods rest where they were more than five years ago. Even without piling further advances in wage and material costs on top of those which have accrued since early 1941, many producers feel increased prices are essential if they are to realize the limited

profit permitted.

The industry feels to a man that further wage increases are inevitable as a result of the new criteria established by the President. Tremendous pressure will develop for further wage increases.

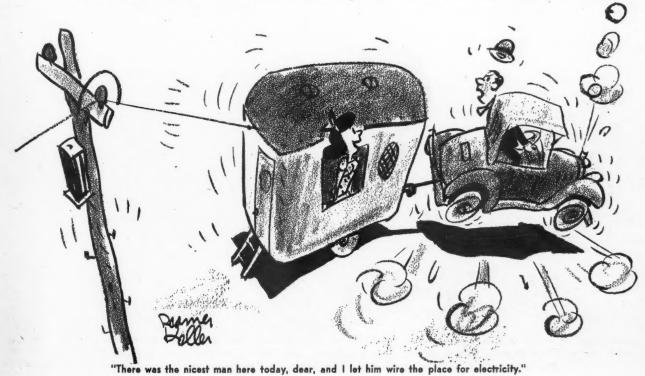
A wide disparity exists in the pay advances different electrical goods producers believe may be required to fulfill the administration's edict. Some estimates run higher than 20 percent, a few who have already granted substantial pay advances in recent months think it may take 5 percent or possibly less. Until a full report is in, a significant average cannot be struck.

Electrical goods producers surveying the position of their raw material suppliers foresee them facing similar wage-price problems. The end result is reflected in a unanimous agreement that material prices also must give way. Many companies estimate an increase of about 10 percent, although advances of as much as 20 percent are expected by some.

In his testimony to the House Banking and Currency Committee, Chester Bowles, the new Economic Stabilization Director, singled out the metal using industries as the one sector of the economy in particular need of price relief. Electrical goods manufacturers fall within this group.

LOCAL CONTRACTORS SUBJECT TO WAGE-HOUR LAW

The Supreme Court decision of January 28, 1946, in the case of Roland Electrical Company v. Walling etc. materially expands wage-hour law





the complete industrial CIRCUIT TESTER (Model 785)

> the versatile SIGHT METER (Model 703)



equipment — all during normal operation without circuit interruption. The clamping jaws are simply placed over the conductor or bus, and current reading taken.

₹ 27 meters in one — with selected AC and DC voltage, current, and resistance ranges. With DC voltage sensitivity of 20,000 ohms per volt, it is ideal for testing photo-cell and sensitive relay circuits, alarm systems, electronic equipment etc., as well as small motors and controls, lighting circuits, etc. Can be used with current transformers and voltage multipliers.

direct-reading, pocket size meter calibrated to measure light values in footcandles, and in "seeing tasks". Equipped with the WESTON VISCOR filter, it measures all light values direct, without correction factors. Models for other requirements,

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coverage according to a review of the case by the NAM Law Department.

In the subject case, the court considered the question of whether employees of the company in Baltimore, Md., whose primary work consisted of the repair of electric motors and other electrical equipment used and consumed by manufacturing companies only in the State of Maryland, were engaged in commerce or in the production of goods for commerce and if so, whether they were exempted from the wage and hour provisions of the Act under section 13(a) (2). That section provides that the wage and hour provisions of the law "shall not apply" to "any employee engaged in any retail or service establishment the greater part of whose selling or servicing is in intrastate commerce."

In concluding that the equipment repair work was production of goods for commerce under the act, the court relied upon the language which states an employee is so engaged when working at "any process or occupation necessary to . . . production." Concerning this definition the court stated:

"... This does not require the employee to be employed even in the production 'of an article which itself becomes the subject of commerce or transportation among the several states. It is enough that the employee be employed, for example, in an occupation necessary to the production of a part of any other articles or subjects of commerce of any character' which are produced for trade, commerce or transportation among the several states . . . There may be alternative occupations that could be substituted for it but it is enough that the one at issue is needed in such production and would, if omitted, handicap the production." (Last emphasis supplied).

Although the disjunctive term "or" is used to link the words "service" and "retail" for purposes of the exemption (which fact has caused many employers to conclude that two distinct exemptions were provided (1) for "retail establishments", and (2) for "service establishments") the court concluded that the exemptions were limited to sales and services "to ultimate consumers of them for personal rather than commercial purposes." In effect, therefore, the court combined the exemptions by applying dictionary and other definition of "retail" to "service" the greater part of which "is in intrastate commerce."

The decision will have far-reaching effect. Practically every type of contractor performing "local" services for commercial companies engaged in production might be expected to be treated as covered by the act. These would seem to include painting, cleaning, and electrical contractors, as well as contractors



Attending the Illuminating Engineering Society's East Central Regional Conference in Philadelphia January 31—February 1 were nationally prominent members (l. to r.) A. D. Hinckley, Executive Secretary IES, New York; A. H. Manwaring, Chairman, Philadelphia Section, Philadelphia, Pa., A. F. Wakefield, national President, IES, Vermilion, Ohio; and Arthur A. Brainerd, Regional Vice-President, East Central Region, IES

furnishing uniforms, laundering, cleaning and catering services for companies whose employees are engaged in production. Other workers apparently brought under the act by the decision are automobile mechanics who rebuild motors for other dealers or who perform work for commercial operators such as traveling salesmen, farmers and bus and truck operators.

Moreover, the court's limited definition of "retail establishment" may now bring under the act's coverage large classes of retailers whose sales are clearly intrastate in nature. These would seem to include coal dealers who sell coal to commercial users such as hotels, apartment house and office building operators; lumber and building material retailers who sell to building and other contractors for use in erecting buildings or other structures for sale; and all other retailers selling goods on the industrial or business market as distinguished from the individual consumer's market such as office furniture.

It would be unrealistic to assume that the working hours of intrastate service and retail establishments have been set in conformity with the maximum hour provisions of the wage-hour law. In order to meet customer demands, local stores and service establishments generally remain open 6 days each week, and the normal working hours of substantial numbers of workers exceed 40 hours. Any firm that has not followed the practice of paying overtime in accordance with the requirements of the wage-hour law may now be subjected to employee suits for underpayments, double damages and attorney fees extending back to 1938 unless the period has been shortened by an applicable state statute of limitations.

This same class of employers have the prospect of being required to readjust wage-rate schedules under proposed amendments to the law which would establish a 65-cent minimum wage immediately and a 75-cent minimum at a later date. This obligation to pay higher wages would be imposed without reference to the ability of the newly affected companies to absorb added payroll costs. Moreover, unless the hearings before committees of the House and Senate are reopened, any higher minimum wage enacted would be imposed upon a large segment of business without the affected employers having been given an opportunity to be heard -and of course, without the Congress being apprised of the overall effect of legislation which it might adopt.

Because of the court's action, it is imperative that Congress obtain many more facts before acting upon the Pepper and other proposals to increase minimum wages under the law; but should enact without further delay a reasonable statute of limitations with a provision to protect from retroactive liability all firms affected by the Roland Electrical Company case.

LIGHTING EXPOSITION PROGRAM

A full parade of What's New in Lighting plus a Conference Program together with many of the industry's outstanding authorities on engineering, contracting, installation, merchandising and selling is assured visitors to the International Lighting Exposition next April 25-30 at the Stevens Hotel.



Latrobe Products Move Quickly

You'll not find any slow pokes or shelf warmers among Latrobe Products. They move right out to the job—and every installation makes new friends. This quick turnover means bigger profits. Better check your stock.



No. 470 "Latrobe" Pipe or Conduit Hanger

Convenient and dependable for hanging pipe on conduit $\frac{1}{2}$, $\frac{3}{4}$ " and i" to steel beams up to $\frac{3}{2}$ " thick.



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Just the thing for fastening porcelain or glass insulators to exposed steel framework.



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Duplex Receptacle Nozzle with 1/2" brass pine extension. Very neat and compact.



No. 252-R Floor Box

A two-gang box with No. 208 Receptacle in one section. One cover plate with $\frac{1}{2}$ " flush brass plug.—the other 2".



Keystone Fish Wire

Flat steel wire of high grade quality. Ten sizes. Colls 100 ft. up.

FULLMAN MANUFACTURING CO. LATROBE . . . PENNSYLVANIA

Rudolph W. Staud, Program Chairman, has announced the complete program of subjects and speakers for the conference sessions. These conferences are to be held the mornings of Friday, Saturday, Monday and Tuesday, April 26, 27, 29, 30. Exposition will be open 12 noon to 6:00 p.m. Friday, Saturday, Sunday, Monday and Tuesday, April 26-30, with a preview for electrical wholesalers on Thursday afternoon, April 25. The program, as released by the Committee is as follows:

April 26, Forum on New Lighting Trends and Methods

"What's Ahead in Industrial and Commercial Lighting" by S. B. Williams, Editor, Electrical World

"Some Fundamentals of Good Lighting" by Ward Harrison, Director, Engineering Division, General Electric Company, Cleveland

"Lighting Research and the Future" by Samuel G. Hibben, Director of Applied Lighting, Westinghouse Electric Corp., Bloomfield, N. J.

April 27, Lighting Sales Forum for Electrical Contractors

"A Program for Developing More Lighting Sales" by W. H. Robinson, Jr., Manager, Advertising Division, Lamp Department, General Electric Company, Cleveland

"Fluorescent Lighting Maintenance as a Basis for Increasing Sales" by Harris Reinhardt, manager, Commercial Engineering Dept., Sylvania Electric Products Inc. Salem Mass.

tric Products, Inc., Salem, Mass.
"Practical Sales Methods for the
Electrical Contractor" by S. C. Sachs,
S. C. Sachs Co., St. Louis

April 29, Lighting Industry Round Table

"What new methods and materials for technical and sales training are now or will be available". Participants—S.



Warren H. Erdman of Line Material Company pointed out the new features of the IES Street Lighting Code to the East Central Regional Conference, Illuminating Engineering Society, held in Philadelphia,, Pa., January 31— February 1.



CARE in designing and building the cores of large AmerTrans results in reduction of generated heat and noise, and in overall high mechanical strength and uniform flux density.

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Care in maintaining corner "squareness"; in eliminating air gaps; in minimizing punch burrs; in shearing tool maintenance—keeps exciting current down, and core losses very low. Highest quality laminations are coated with special flashed on mineral enamel—resists high temperatures, is very thin and resilient.

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- **Exceptional Engineering Service.** The wide experience of our Engineering Department has included the most difficult problems of switchboard design. We can send an engineer to combine our experience with yours, in planning a job.
- Highest Standards. The wide preference for Pelham Switchboards is largely due to the knowledge of electrical engineers that "Pelham" on a board definitely guarantees the best of materials and workmanship.
- Unusual Cooperation. We take full responsibility for meeting all specifications of architects and engineers, as well as municipal, state, or federal requirements. Our deliveries are made when promised.

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SWITCHBOARDS • PANEL BOARDS • SWITCH GEAR AND ACCESSORIES



Contractor H. C. Adolphsen, Milwaukee, Wis., discusses systematic pricing methods with Wm. G. Hazel, Henderson-Hazel Corporation, Cleveland, Ohio.

R. Naysmith, Chairman, Industrial and Commercial Lighting Equipment Section, NEMA; F. M. Spaugh, Chairman, Floodlighting Section, NEMA; A. F. Dickerson, Chairman, Street and Traffic Safety Lighting Bureau, NEMA; A. F. Wakefield, President, Illuminating Engineering Society; Henry Steinmetz, Chairman, Better Light Better Sight Bureau; J. S. Schuchert, Chairman, Sales Personnel Committee, Edison Electric Institute; G. B. Roscoe, Director, of Public Relations, NECA; C. G. Pyle, Managing Director, NEWA; Harold H. Green, Advertising Division, Lamp Department, General Electric Company, Cleveland; D. W. Atwater, Manager, Commercial Engineering Dept., Westinghouse Electric Corp., Bloomfield, N. J.; and Garlan Morse, Lamp Merchandise Manager, Sylvania Electric Products, Inc., Salem, Mass.

Monday Evening—Annual President's Night and Electrical Industry Dinner, Chicago Section, IES, Stevens Hotel.

April 30, Forum on Lighting Service and Lighting Application

"How a utility lighting program can improve public relations and build customer good will" by I. L. Illing, Assistant sales Manager, Wisconsin Electric Power Company, Milwaukee; H. A. Stroud, Sales Promotion Manager, Monongahela Power Co.; and R. W. Butts, Lighting Director, The Ohio Public Service Company, Elyria, Ohio

"How manufacturers' data sheets and specification sheets may be more effectively used in a utility lighting program." The Utility Viewpoint by A. A. Brainerd, Illuminating Engineer, Philadelphia Electric Company and James J. Oberhausen, Illuminating Engineer, Commonwealth Edison Company, Chicago and the Manufacturers' Viewpoint by H. P. Steele, vice president, Benjamin Electric Mfg. Co., Des Plaines, Ill. and W. P. Lowell, Jr., Chief Engineer, Lighting Fixture Division, Syl-

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When planning wiring jobs in which power, control or lighting circuits are exposed to high temperatures, corrosive fumes or other severe conditions . . . insure against premature wire-failure by specifying permanently insulated Rockbestos A.V.C.

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The Wire with ROCKBESTOS



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In 600, 1000, 2000, 3000

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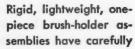




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"The trends in lighting equipment design and lighting practice as revealed by the exhibits at the International Lighting Exposition." by Marshall N. Waterman, Electrical Testing Laboratories, Inc., New York, and B. J. Jensen, Assistant General Lighting Representative, Public Service Electric and Gas Company, Newark, N. J.

RESIDENTIAL WIRING HANDBOOK READY FOR DISTRIBUTION

The "Handbook of Residential Wiring Design," a 32-page handbook prepared by the All-electrical Industry Committee on Interior Wiring Design, representing ten leading trade associations and technical societies in the electrical field, is now off the press.

A companion piece, the "Handbook of Farmstead Wiring Design," is expected to be published shortly, according to the committee.

The residential handbook is a complete revision of the residential standards appearing in the Handbook of Interior Wiring Design published in 1937, and is now available for the first time under separate cover. The farmstead handbook is the first of its kind to be published.

The electrical industry's postwar wiring program will be spurred by wide distribution of the handbooks to the home building, home buying and home modernizing public, the committee feels. Exceptionally low quantity prices have been established, and over 100,000 copies of the handbooks were ordered in advance of publication.

The handbooks are the result of over a year's planning and preparation by the joint committee representing the following organizations: American Institute of Electrical Engineers, American Home Lighting Institute, American Society of Agricultural Engineers, Edison Electric Institute, Illuminating Engineering Society, International Association of Electrical Inspectors, National Electrical Contractors Association, National Electrical Manufacturers Association, and Radio Manufacturers Association, and Radio Manufacturers Association.

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The handbooks, according to the committee, will be of substantial aid to architects, engineers, contractors, lending institutions and other organizations concerned with home building and planning. Prospective home owners and those now planning remodelling of their present homes will find practical, efficient wiring systems, with both floor plans and text easily understood by men with no technical experience.

The residential handbook summarizes the latest authoritative experience of the electrical industry on wiring systems adequate for present and future needs in the home. Both floor plans and text show how every room in the average home should be wired, with the number, type and location of outlets recommended by the committee's experts. Pages on circuit requirements, service entrances and a sample wiring specification form are included, with electrical symbols for floor plans.

A need for better wiring in old homes and for the millions of dwellings to be built in postwar years has long been obvious to the electrical industry. The twin bottlenecks of inadequate wiring capacity and too few outlets to permit unrestricted use of electrical appliances have hindered promotion and selling throughout the nation. The practical, up to the minute and reliable information contained in the residential and farm wiring handbooks can be employed to aid millions of home owners to enjoy all their present appliances, and to add new electrical servants in confidence that their service will not be impaired by lack of outlets or current.

Single copies of the Handbook of Residential Wiring Design cost 25 cents; in quantities of 10 to 99 copies six cents each; 100 to 999 five cents each; and 1000 or more four cents each.

The Handbook of Farmstead Wiring Design are 40 cents per copy and in quantities of 10 to 99 ten cents each; 100 to 999 copies eight and one half cents each; and 1000 or more seven cents each.

NECA ASKS CONGRESS STOP DISCRIMINATORY POLICIES OF REA

The National Electrical Contractors Association has asked Congress to write into pending legislation affecting the Rural Electrification Administration provisions forbidding that agency from discriminating against a contractor because he happens to be performing a contract for a private utility company.

In a letter to the Subcommittee on Federal Power of the House Interstate Commerce Committee, NECA pointed out that electrical contractors apparently are being made victims of feuding between REA and private utilities whom REA seems to regard as competitors,

Col. O. R. McGuire, General Counsel of NECA, told the Subcommittee that repeated attempts to get REA to cease its discriminatory policies had failed and that the only course left for correction appeared to be the Congress.

The Subcommittee, whose chairman



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is Oren H. Harris, D., Ark., is now considering H.R. 1742, a bill to let REA proceed with major rural electrification plans and to authorize RFC to lend REA an additional \$585,000,000 in the next five years. The Subcommittee held extended hearings on the subject last

In addition to refusing to do business with an electrical contractor solely on the grounds he might happen to have a contract with a private utility, REA is criticized by NECA for receiving competitive bids, which frequently are rejected, and in their place are substituted negotiations for lower quotations conducted privately with the bidders-in other words, bid shopping.

3000 VISIT MILWAUKEE SHOW

The Electrical Maintenance Engineers of Milwaukee sponsored one of their best trade shows held at the Public Service Building Auditorium on January 31 and February 1st. The twin-evening showing of the Seventh Annual Industrial Electrical Exposition drew a record crowd of some 3000 engineers, contractors, service shop men, maintenance men and others interested in electrical construction and maintenance-many coming from far outlying

Awaiting the visitors as they filed through the auditorium entrance were the exhibits of more than 40 manufacturers and distributors of electrical equipment (including several local motor service shops) covering everything from the minute wire connector to electric welders, complicated electronic controls and instruments, plant materials handling equipment. Interest in individual exhibits was about evenly divided—each being carefully scruti-nized by the crowds. Electrical controls of all types, lighting, meters and cathode ray oscilliscopes, wiring and maintenance materials and accessories were given a considerable share of the spectators' attention.

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Being the first postwar show in the area, visitors were naturally eager to see "what's new". But the strike-hampered manufacturers were at a disadvantage and could show little in this category. Although a faint trace of mild disappointment was in evidence, visitors eagerly asked questions, posed problems and went away with their answers and a clearer conception of what is and will be available in the industrial electrical field. All took advantage of the opportunity to meet the manufacturers' representatives and get better acquainted with the production and distribution phases of the industry.

The successful exhibit was concluded



Watching Harry Halinton, Harry Halinton, Inc., operate cathode-ray oscilloscopes are J. J. Kirscher, AllisChalmers Mfg. Co., and a group of interested visitors at recent Milwaukee EME Electrical Trade Show.

with the EME Annual Dinner Dance. Both the Maintenance Engineers and the Exhibitors are now looking forward to the next year's show when they are confident many new developments can be offered.

FEDERAL BUILDING PROGRAM DEFERRED

Deferment of Federal construction which would compete with veterans' housing for men and materials has been agreed upon by the Inter-Departmental Committee on Construction, which is composed of Federal Departments and Agencies interested in construction, it was announced recently by Wilson W. Wyatt, National Housing Administrator and Housing Expediter.

At the same time, the Committee gave its support to increased construction of community facilities—such as streets, sewers, waterworks and other utilities—which will be necessary to permit the Veterans Emergency Housing Program to move forward with full speed.

The Committee, headed by Major General Philip B. Fleming, Administrator of Federal Works Agency, assured John W. Snyder, Director of the Office of War Mobilization and Reconversion, and Mr. Wyatt of its "whole-hearted cooperation" in the realization of the objectives of the housing program—2,700,000 homes for veterans by the end of 1947. It declared that "the Federal Building program contemplated by the Public Buildings Administration will, if authorized, be 'timed' to the extent necessary" to avoid any conflicts.

The Committee went on record as favoring going forward with highway projects, reclamation projects, river and harbor improvements and flood control projects, "because it is the unanimous judgment of the committee that those types of production make no demand, or only an insignificant demand on the types of materials and labor skills useful



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in housing construction and "will help provide jobs of the kind for which thousands of veterans were trained during the war".

IES EAST CENTRAL REGION CONVENES

A review of lighting progress through the war years, and a preview of the lighting program ahead, formed the basis for the program of the East Central Regional Conference of the Illuminating Engineering Society held in Philadelphia, Pa. on January 31 and February 1. Over 200 members and guests registered for this two-day conference.

A. F. Wakefield, national president of IES, reported on society affairs, including the activities of various committees. He stressed the importance of committee work and urged all members of committees to turn in prompt reports. Much progress has already been achieved in committee work, he pointed out, as he detailed many of the major committee activities to date.

Arthur A. Brainerd, regional vice president of the East Central Region, discussed planning of IES activities in the region. He complimented the chairmen of the local sections forming the East Central Region on the meetings held to date, and on their plans for future meetings during the remainder of the year. Section chapters forming the East Central Region are: Capitol Section, Washington, D. C.; Pittsburgh Section, Pittsburgh, Pa.; Philadelphia Section, Philadelphia, Pa.; and Baltimore Chapter, Baltimore, Md.

One highlight of the dinner meeting held at the end of the first day's session was a talk by J. L. Kilpatrick, chairman, IES Lighting Education Committee, in which he gave a glimpse of postwar Germany. As a member of the Technical Industrial Intelligence Committee which visited Europe immediately after V-E Day, Mr. Kilpatrick investigated lighting developments by the enemy during the war. Very little progress was found, he said, which would supersede developments known and discussed at the last meeting of the International Congress on Illumination, held previous to the war. His vivid description of the waste and ruin that was Germany's at the end of hostilities left little for the imagination.

A. H. Manwaring, chairman, Philadelphia Section, opened the two-day session by introducing A. L. Hallstrom, President, Philadelphia Chamber of Commerce and Board of Trade, who welcomed the members and guests to the Quaker City.

C. A. Conklin, chairman, Pittsburgh

Section, presided at a Lighting Service Forum. The first paper covered "School Lighting Practice," by C. C. Shotwell, Philadelphia Electric Company. Mr. Shotwell pointed out that illuminating engineers and lighting men have a definite moral and community obligation in dealing with school lighting. He suggested that commercial instincts be suppressed, and that basic principles and truths be adhered to in order to minimize confusion and to convey a feeling of confidence to large committees who must pass on final lighting plans. Past school lighting practice, especially in classrooms, was reviewed. Progress in light sources, resulting in a much larger assortment of types, sizes and shapes, was pointed out. New lighting practice is now necessary in order to achieve best engineering and economic conclusions, with respect to intensities, glare, shadows, and other favorable or unfavorable results in the form of brightness, maintenance and good housekeeping, Mr. Shotwell stated. He suggested that the new IES "Recommended Practice for School Lighting," due to be published early this year, be used as a guide for preparation of school lighting recommendations. He reveiwed what these practices will cover, and quoted footcandle levels which will be listed for various locations throughout the school building. Seventyfive foot-candles will probably be approved by sight-saving classrooms, drafting rooms and sewing rooms, he stated, and 40 footcandles for classrooms; study halls, lecture rooms, art rooms and laboratories.

The second paper on this Forum covered "Office Lighting Practice." It was prepared and presented by C. J. Berry, Consolidated Gas Electric Light and Power Company of Baltimore. Improvements in office illumination promise to be a major factor in the lighting field. Mr. Berry said. Most offices still have incandescent lighting, he pointed out, and a large portion of office space is poorly lighted. Much lighting progress was made in office lighting during the war as a result of intensive lighting activities in war plants, he stated.

In order to effect good "seeing" in offices, many factors must be taken into consideration in addition to the type, arrangement and number of lighting units, Mr. Berry pointed out. They include color and size of the seeing tasks, finish of desk tops, office machines and furniture, and the color and diffuse reflection factors of walls, ceilings and floors, he stated. Ceilings should be painted a flat white with reflection factor of 85 percent or higher, side walls should be finished in light colors with 50 to 60 percent reflection factor, furniture should be finished in lighter colors, with desk tops having a reflection factor of 40 to 45 percent, and floors should be a light color which reflects at least 35

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percent of the light, he said. Brightness ratios of 3 to 1 or lower should be maintained, he stated, while brightness contrast should be high. He defined brightness contrast as involving an immediate area, and brightness ratio as involving a surrounding field. Brightness distribution was stressed as being highly important. Reflected glare should be eliminated in all cases. A number of slides were used to illustrate good office lighting practice.

A "Planned Lighting Program" formed the basis of the third paper on the Lighting Service Forum, presented by J. S. Schuckert, Duquesne Light Company, Pittsburgh, Pa. This planned lighting program was described as one which would give a customer for lighting a measuring stick to help him out of the confusion brought about by many new lighting developments, Mr. Schuckert stated. Conceived and applied in one large metropolitan area, it is a flexible program, and has sufficient merit to be considered industry-wide, he said. He briefly summarized the program as one in which the customer is told to have his lighting "planned" before he buys it. Simple in concept, it is not quite so simple in execution, Mr. Schuckert pointed out. He outlined four main parts which enter into the operation of such a planned program, as follows: recognition of the need of a Planned Lighting program; execution of the program; the promotional effort to support it; and the extension and enlargement of the program. To be most effective, such a program should be industry-wide, it was stated, participated in by manufacturers, wholesalers, electric utilities, electrical contractors and electrical dealers. If successfully accomplished, everyone participating in this program would benefit, it was stated, but the customers would obtain the greatest gain-the benefits of a good lighting installation, and a safeguard against a poor investment.

The economy of proper lighting maintenance was discussed by Frank Moos, lamp and lighting specialist, Graybar Electric Company, Inc., Philadelphia. Lack of proper evaluation of a good lighting system and the justification of good maintenance are doing much to lessen the benefits to productivity, he stated. Two case examples were cited in which the illumination level had fallen to approximately 50 percent within one year. In one case, an industrial installation, soap and water used on the lighting equipment restored the lighting intensity to approximately its initial value. In the other case, a commercial installation, repainting the ceiling and use of soap and water on the lighting equipment brought the illumination levels back to approximate initial value. Mr. Moos listed five factors which owners should take into consideration when acquiring a lighting system. These were: to make sure (1) that the equipment is designed for easy maintenance; (2) that it is designed for the specific requirements; (3) that it is installed correctly by a reliable contractor; (4) that it is set up and followed through with a maintenance program; and (5) that correct operating voltages are maintained at the

point of equipment. Warren W. Langston, manager, fluorescent Lighting Division of The Jack Stone Company, electrical contractors of Washington, D. C. discussed the operation of a fluorescent lighting maintenance service. He reviewed in detail the operation of the Maintenance Division which he heads. It has been in operation for a period of more than one year. This service is sold on a 12 to 24 months' contract basis, he stated, and consists of a systematic service covering all fluorescent lighting equipment involved in each contract. A complete survey of equipment is made before any contract is entered into, it was stated. This survey covers such factors as terminal voltage, ballasts, lamps, lampholders, starters, and careful check of construction of the fixtures used, including quality and ease of assembly. The average cost of this specialty electrical service to the customer is approximately \$3 per lamp per year, Mr. Langston said. He pointed out, however, that this price would vary throughout the country, depending primarily upon the labor cost. The success of the operation of a maintenance service, he stated, depends primarily upon proper management, cooperation of customers, use of trained salesmen, specially trained mechanics, promptness in answering trouble calls, thoroughly equipped rolling equipment, and an adequate supply of dependable replacement

A report on "Progress in Light Sources" was presented by R. G. Slauer, Sylvania Electric Products, Inc., Salem, Mass. Samples of many lamps developed during the war were displayed for inspection. The report covered infrared, ultraviolet (germicidal and sunlamp), mercury vapor and fluorescent lamp sources.

George R. Baumgartner, General Electric Company, Nela Park, Cleveland, discussed "Progress in Lighting Equipment." Typical fixture examples were displayed, and included several types of direct lighting units, such as louvered spots, lens spots and wide angle units, housings for R-40 spot or flood lamps, newly designed units for slimline lamps and circline lamps, and units using various types of diffusing and shielding devices for all types of fluorescent lamps.

A highly interesting and complete symposium on the "Lighting of Small Airports" was presented by officials of Civilian Production Administration,

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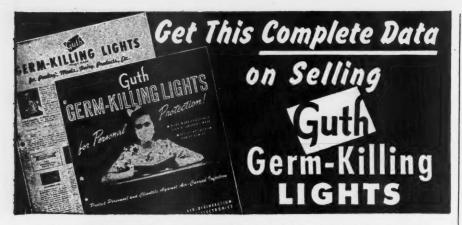
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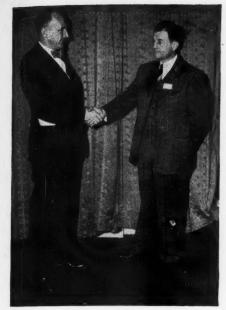
and the Navy. A short review of airport lighting problems, both civil and military, during the war years, the necessity for close liaison between Army, Navy and CAA, and how this was accomplished, was presented by A. A. Fox, now Chief of the Electrical Section of Civilian Production Administration, and during the war Administrator of the Airport Lighting Equipment limitation order L-235, issued by the War Production Board. Mr. Fox pointed out the necessity for continued close work between Army Air Forces, Bureau of Aeronautics of the Navy, and the Civil Aeronautics Administration in order to achieve standard lighting procedures on all airports, including foreign airports. C. R. Seybold and L. C. Vipond of

Civil Aeronautics Administration, Na-

tional Bureau of Standards, the Army

the Civil Aeronautics Administration gave a brief outline of the National Airport Plan now under consideration by Congress. This plan involves the construction of approximately 3000 small airports in communities throughout the United States. Need for better lighting facilities, and for lower costs on lighting equipment, was stressed. On estimates of costs for the proposed airports, 5.4 percent of the total would be required for lighting equipment and installation, including beacon, boundary, obstruction, range, runway and taxiway flood or contact lights, and wind ties or tetrahedons. This percentage would total over \$55,-000,000. Tests now in progress on various types of portable and fixed lighting units were reviewed.

The military aspects of the "Lighting of Small Airports" from the Army's viewpoint were presented by Lt. Col. J. P. Huebsch. The proposed small airport program of CAA anticipates a great expansion of private flying, which will form the primary training ground for a potential reserve of military pilots, he stated. Certain fundamental aspects of aviation facilities should be uniform whether for the pilot of a "pudddlejumper" or a four engine bomber, since in the final analysis, the pilot's reaction to what he sees is the same in either case, Col. Huebsch pointed out. A technical committee, comprising representa-tives of AAF, Bureau of Aeronautics of U. S. Navy Department, and CAA, functioning since its formation in 1941, will continue, he stated, and has acchieved considerable standardization of airfield and seadrome lighting equipment and installation practice, and a national standard with respect to color sequence is now in effect. Preservation of certain fundamental standards of lighting, particularly color sequence, reasonably adequate light intensity, and dependability of operation should be strongly advocated, Col. Huebsch stated, to enhance flying safety and even greater public acceptance of aviation.

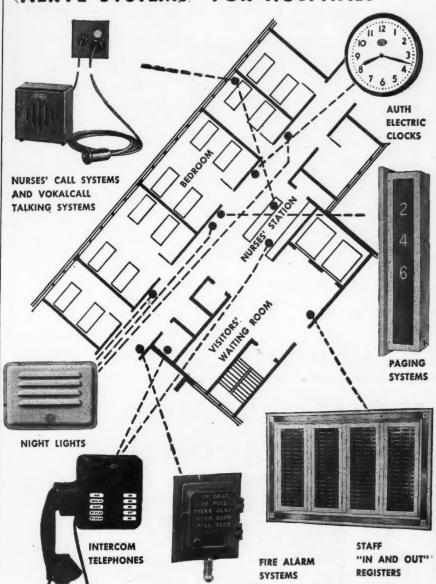


Frank Moos, Lamp and Lighting Specialist, Graybar Electric Company, Philadelphia (left) and Warren W. Langston, Manager, Fluorescent Lighting Maintenance Division, The Jack Stone Company, Washington, D. C. (right), joined hands on lighting maintenance discussions, part of the program of the IES East Central Regional Conference, Philadelphia, Pa., January 31—February 1.

Lt. Martin A. Warskow, U. S. Navy, presented knowledge which the armed forces gained from their experience in lighting all types of airports during the war. He also described equipment now in use, or under development, which may have some application in lighting small airports. Reflective and electrical markers were discussed in detail. Out of his experiences with military airports and seadromes, he concluded that much opportunity exists for original equipment design for the lighting of small airports. His discussion covered portable field lighting sets, typical field lighting layouts, runway marker spacings, etc., supplemented with pertinent criticism.

F. C. Breckenridge, National Bureau of Standards, Washington, D. C. presented the scientific aspects of the lighting of small airports in a paper aptly titled "What We May Expect from Low Cost Airport Lighting." Low cost airport lighting will greatly increase the value of the airports to which it is applied, he stated, but it must be regarded as clear-weather lighting, he concluded, and proceeded to point out why, through a discussion of candle-power penetration of intervening atmosphere. Powerful contact lights and approach lights are being designed for all-weather airports, but such systems are expensive, he said, and out of reach for small airports. Low cost lighting should, in general, be satisfactory for lighting small airports, essentially for clear-weather lighting.

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International aspects of the lighting of small airports were discussed by James F. Angier, Civil Aeronautics Administration, Washington, D. C. International standardization of color and pattern is well on its way, Mr. Angier stated, but does not cover intensity and construction. Action in this regard will be sponsored by the United States at forthcoming conferences of the Provisional International Civil Aviation Organization, he said. International airports will in all probability follow International Standards and Recommended Practices, now in process of being printed, he pointed out. But small airports should also follow suit so that once a plane has landed in the United States at an International airport, it may make other flights across the country to local fields which are lighted to the same lighting standards.

Warren H. Edman, Chairman of the Street and Highway Lighting Committee, IES, discussed the meaning of the new features of the IES Street Lighting

Code.

Lighting for Outdoor Recreation was discussed by J. W. Steiner, Westinghouse Electric Corporation, Cleveland, Ohio, a member of the Sports and Recreational Area Lighting Committee, IES. Baseball field lighting layouts, how they are analyzed by models and photography, were discussed at length, and explanations given for locations of light towers. Lighting layouts for football, softball, playgrounds, tennis and other reports, were also discussed.

Other papers, each giving a solution of a typical lighting problem, were presented by the following: Denny Freeman, Public Buildings Administration, Washington; G. W. Wagner, Philadelphia Electric Company, Philadelphia; K. C. Larabee, Lamp Department, General Electric Company, Philadelphia; H. M. White, Consolidated Gas Electric Light and Power Company, Baltimore; and L. T. Kight, Duquesne Lighting Company, Pittsburgh.

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Three colored sound films were shown during the conference. They were: "Seeing is the Biggest Thing in Selling" and "Magic of Fluorescence," produced by the General Electric Company, and "The Dawn of Better Living," produced by Westinghouse Electric Corporation.

The afternoon of the second day of the conference was devoted to inspection trips. Two recently installed modern school lighting installations constituted one trip. Drafting room lighting and machine shop lighting were the subjects for two other trips. An industrial plant installation containing both commercial and industrial lighting constituted one of the trips. A list of 28 stores in Philadelphia containing outstanding and unusual applications of lighting techniques was furnished to those interested in this subject.

SHARP INCREASE IN RESIDENTIAL CONSTRUCTION

Gains in the number of new dwelling units involved in construction contracts awarded in the 37 states east of the Rocky Mountains in the fourth quarter of 1945 were reported today by F. W. Dodge Corporation.

The comparative figures of new dwelling units for the final quarters of 1945 and 1944 were 28,180 and 12,268, a report prepared by the corporation's statistical division reveals.

The sharp and contraseasonal gains in the final quarter were sufficient to make the total of new dwellings for the year 21 per cent in excess of those provided in 1944, the 1945 total being 76,495 units, a spokesman for the corporation said. Approximately one out of every seven dollars involved in the 1945 residential contracts was for public housing, an analysis of the figures shows.

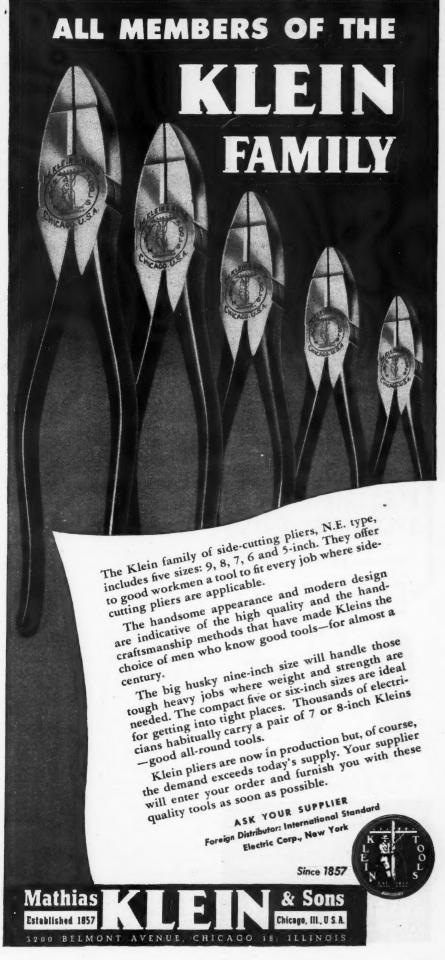
Increases in commercial, manufacturing, educational, hospital and religious building during the year were also reported.

The total of all construction contracts awarded in the 37 states during the year 1945 was \$3,299,303,000 compared with \$1,994,016,000 in the previous year. The volume in 1945 exceeded that for 1943 also, and was at a level slightly in excess of that for 1938, the corporation's statistics show.

ILLINOIS INSPECTORS HOLD STATE MEETING

Convening at the Hotel Sherman, Chicago, January 24-25, approximately 150 electrical inspectors from all parts of Illinois attended the annual conference of the Illinois Chapter, IAEI. The theme of the two-day session centered around reconversion and the pertinent problems confronting the engineer, inspector, wholesaler, contractor and manufacturer.

Frank K. Hanlin, assistant electrical engineer, Underwriters' Laboratories, Inc., Chicago, reviewed the Laboratories procedure for testing of lighting fixtures. Particular attention is given to portion of units over which fixture wire must pass, he stated. Discussing safe operation of fluorescent fixtures, Mr. Hanlin revealed that, although U.L. will accept unrated capacitors, fluorescent ballasts are tested with the capacitors shorted out to make certain that a capacitor failure will not overheat the ballast beyond the safe limit. He warned that a deactivated fluorescent lamp, if not removed from a fixture, will





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Patented construction eliminating end ferrules on the larger sizes makes fuse pulling safe.

. SIMPLIFIED CONSTRUCTION!

Only two parts besides the link means quicker renewal and no parts to lose.

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Scientifically designed links eliminate unnecessary blow-outs and save both time and money.

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By comparing the heavy cartridge wall with ordinary fuses, one realizes the added strength of Solar fuses.

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SHAPES • ALL VOLTAGES • ALL TYPES
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RUSGREEN MFG. CO.

place a greater load on a ballast than a bad starter. Fixtures for use with instant start lamps must be so marked as must units designed for recessed mounting, Mr. Hanlin revealed.

The building materials picture is indeed dark according to the report of A. J. McGivern, managing director, Chicago Electrical Wholesalers Association. Lumber is one of the tightest commodities, he asserted, with only two billion board feet in the yards today, compared to a normal supply of seven billion feet plus another seven billion feet at the mills. The supply for 1946 will be approximately 25 percent of normal. Material availability will be about the same in the brick and plumbing industry where labor shortage is the serious bottleneck. The steel industry is five to six months behind on orders now-will be worse due to strike -and production of light steel (for housing, electrical industry, etc.) is and will be poor, Mr. McGivern cautioned.

The electrical conduit shortage is serious as is that of low and moderate priced wiring devices. On top of this, several wire manufacturers have announced discontinuance of production of No. 14 Type R building wire, according to Mr. McGivern who warned that these shortages will continue after the strikes are settled. Under these conditions, and with all building mechanics employed at present, he sees only about 200,000 housing units being built this year instead of the proposed one million units.

Ambitious plans for the rehabilitation of Chicago's slum areas—with particular emphasis on housing—were outlined by H. Evert Kincaid, executive director, The Chicago Plan Commission. Declaring that 18,000 dwelling units were built in the city during the war, Mr. Kincaid reiterated the need for improvements to assure future growth of the city which is the hub of the industrial midwest. The Commission's comprehensive plans envisions every activity including private and public construction programs.

As is usual in all inspector meetings, a major portion of the program was devoted to a discussion of the Code and inspection problems. An open forum on Articles 210 (Branch Circuits), 220 (Feeders) and 230 (Services) was led by O. K. Coleman, consulting engineer, Lafayette, Indiana. Mr. Coleman, a member of the Electrical Committee, NFPA, representing the electric light and power group, answered questions about these articles and explained the reasons for recent Electrical Committee action in each case. Roy Burgess, assistant chief electrical inspector, City of Chicago, led the "Inspectors' Problems" clinic.

While reviewing the 1946 National Electrical Code changes, Victor H.

Tousley, electrical field engineer, NFPA, revealed that an amendment to the table under Section 4327 was proposed and adopted on the floor of the Electrical Committee meeting. This was to the effect that a 3-phase motor supplied from a transformer having a star-connected primary and delta-connected secondary should have one overcurrent trip coil in each leg of the motor protective device (present code requires two coils for 3-phase motors). Chances are, according to Mr. Tousley, that the Electrical Committee will ask for reconsideration and deletion of this amendment since its inclusion would require too great a change in manufacturing procedure-the two-pole overcurrent device being almost a standard item at present.

The National Electrical Code guides the electrical contracting industry and its importance cannot be overestimated. stated George Andrae, vice-president, Herman Andrae Electric Company, Milwaukee, Wisconsin (and a NECA member of the Electrical Committee, NFPA), who outlined in detail the many important revisions and new additions of the 1946 NEC ("What's in the '46 Code," E. C., Dec. 1945, p. 54). Following his discussion, Mr. Andrae erased a misconception that the National Electrical Contractors Association favored bare neutral wiring. He reiterated that NECA still maintains its policy of not advocating this type of wiring system, a country-wide field survey having provided no authoritative or conclusive basis for changing the association's position in this report.

Conference delegates were given an insight into the manufacture of armored cable through a film presented by H. M. Dreher, electrical engineer, Armored Conductor and Flexible Metallic Conduit Section, NEMA, New York. A healthy floor discussion of this specific type of wiring system brought forth one outstanding conclusion: Any difficulty experienced with armored cable installations have invariably been traced to improper installation, poor workmanship in cutting the armor and omission of insulating bushings at outlet box connections.

Through a resolution, the Chapter recommended that Article Committees 240 and 430 review Sections 2434-d (fusing 25-ft. taps) and 4349 (over-current protection of feeder taps) with a view to eliminating apparent existing conflicts and inconsistencies.

At the final business session the following Chapter officers were elected: Chairman, E. E. Dodds, Chicago; first vice-chairman, H. C. Frieden, Moline; second vice-chairman, J. A. Trovillo, Chicago; third vice-chairman, J. T. Swanson, Rockford. W. J. Alcock, Chicago, was re-elected secretary-treasurer.

Elected to membership on the Executive Committee were: P. J. Markey (chairman), Commonwealth Edison Company, Chicago, utilities; Emil DeHaan, Service Electric Shop, Chicago, contractors; James Ryan, F & G Electrical Supply Co., Chicago, wholesalers; Neil Driscoll, Square D Company, Chicago, manufacturers.

DATES AHEAD

North Central Electrical Industries—First Postwar combined electrical industry convention and trade exposition—Radisson Hotel, Minneapolis, Minn., March 10-14.

Rocky Mountain Chapter—IAEI—Rm. 385 City and County Bldg., Denver, Col., March 12.

Chicago Technical Societies Council—Production Show and Conference—Stevens Hotel, Chicago, Ill., March 20 to 22.

Midwest Power Conference—Palmer House, Chicago, Ill., April 3-5.

National Electrical Manufacturers Association — Spring Meeting — Palmer House, Chicago, Ill., April 8.

Rocky Mountain Chapter—IAEI—Rm. 385, City and County Bldg., Denver, Col., April 9.

National Industrial Service Association— National Convention—Tampa, Fla., April 8-10.

American Society of Tool Engineers—Fifth Annual Exposition—Public Auditorium, Cleveland, Ohio, April 8-12.

Wisconsin Electrical Association—Annual Conference, Hotel Loraine, Madison, Wisconsin ,April 19-20.

National Electrical Wholesalers Association
—37th Annual Convention — Stevens
Hotel, Chicago, Ill., April 21–25.

Society of the Plastics Industry—First National Plastics Exposition—Grand Central Palace, New York, N. Y., April 22-27.

International Lighting Exposition, NEMA—Stevens Hotel, Chicago, Ill., April 25-30.

Chamber of Commerce—Annual Meeting—Atlantic City, N. J., April 29 to May 1.

"Products of Tomorrow Exposition"—Chicago Coliseum, Chicago, Ill., April 27—May 18.

National Modern Homes Exposition—Metropolitan Association of Real Estate Boards—Grand Central Palace, New York, N. Y., May 4-11.

Housewares Show—National Exhibition— Convention Hall, Atlantic City, N. J., May 13-17.

Rocky Mt. Chap.—IAEI—City and County Bldg., Denver, Col., May 14.

National Fire Protection Association—50th Annual Meeting—Hotel Statler, Boston, Mass., June 3 to 6 or 7.

Rocky Mt. Chap.—IAEI—City and County Bldg., Denver, Col., June 11.

National Electrical Manufacturers Association—The Homestead, Hot Springs, Va., June 17-19.

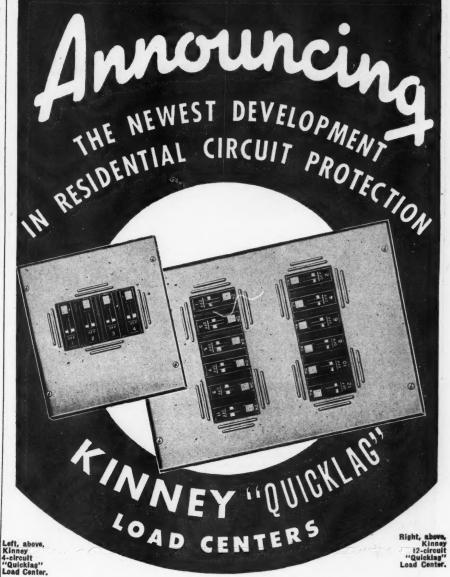
American Institute of Technical Engineers
—Summer Convention, Detroit, Mich.,
June 24 to 28.

Rocky Mt. Chap.—IAEI—City and County Bldg., Denver, Col., July 9.

Southern California Construction Industries—Exhbition and Home Show—Pan-Pacific Auditorium, Los Angeles, Cal., July 12-21.

Pacific Coast Convention—AIEE—Seattle, Wash., August 26 to 31.

Rocky Mt. Chap—IAEI—City and County Bldg., Denver Col., August 13.



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Cash in on the coming building boom, and sell Kinney "Quicklag" load centers. They are available in 2, 3, 4, 5, 6, 8, 10, 12, 14 and 16 circuit sizes, with 15 to 50 ampere breakers. Write NOW for the attractive Kinney catalog which includes "Quicklag" load centers, and get the facts.

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123 N. Sangamon Street • Chicago 7, Illinois 112 Charlton Street • New York 14, N.Y. Rocky Mt. Chap—IAEI—City and County Bldg., Denver Col., September 10.

Illuminating Engineering Society—National Convention—Chateau Frontenac, Quebec, Canada, September 18-21.

International Municipal Signal Association, Inc. — Annual Meeting — Miami Colonial Hotel, Miami, Fla., October 14 to 17.

Rocky Mt. Chap—IAEI—City and County Bldg., Denver Col., October 8.

National Electrical Manufacturers Association — Annual Meeting — Marlboro-Blenheim and Claridge Hotels, Atlantic City, N. J., October 28 to November 2.

All Industry Refrigeration Show—Public Auditorium, Cleveland, Ohio, October 28-31.

MANUFACTURERS NEWS _____

G. A. PRICE PRESIDENT OF WESTINGHOUSE

The Westinghouse Electric Corporation has announced the election of Gwilym A. Price as president, succeeding George H. Bucher, who has resigned from that office. Under a recent amendment of the Corporation's by-laws, Mr. Price as president will be the chief ex-



G. A. PRICE

ecutive officer. He was elected a vice president in September, 1943, and had been executive vice president since May, 1945. He was elected a member of the Corporation's Board of Directors in

January, 1945.

A. W. Robertson was elected chairman of the Westinghouse Board of Directors and Mr. Bucher vice chairman. Mr. Bucher will continue to serve as chairman of the Westinghouse Electric International Company.

Carl E. Nagel has been appointed manager of Editorial Service. He will be responsible for the Company's technical and trade magazine articles.

The appointment of R. W. Gemmell as manager of the Aircraft Sales Department, Small Motor Division, has been announced. Mr. Gemmell, who was special representative of the division in the Pacific Coast District, succeeds N. C. Reed, who was transferred to the Elevator Division of the Company in Jersey City.

GENERAL ELECTRIC CHANGES

In order to obtain a more comprehensive industrial application engineering coverage, three new divisions have been added to the General Electric Company's Industrial Engineering Divisions. The new divisions are Power Electronics, Materials Handling & Testing Equipment, and Rubber & Printing. In addition, the Machinery Division has been reorganized.

The new Power Electronics Division, headed by L. W. Morton, is concerned with the application of electronics to the problems of power conversion in industry. The Materials Handling & Testing Equipment Division deals with elevators, cranes, and hoists, as well as with electrical equipment used in wind tunnels and for testing jet and conventional aircraft engines. M. A. deFerranti has been named engineer of this division. The Rubber & Printing Division is under the direction of G. W. Knapp. The reorganized Machinery Division is headed by H. W. Poole.

L. K. Alexander has been appointed manager of the Ken-Rad Division of G-E's Electronics Department with headquarters at Owensboro, Ky.

I. A. Lee has been appointed sales manager of special rectifier sales and R. F. Hinckley as sales manager of the Tunger & Metallic Rectifier Division, Bridgeport, Conn.

Three managers for the General Electric Company's Boston Appliances Distributing Branch has been announced. L. F. Simcock is sales manager of the branch's Merchandising Dealer Division; F. V. Cunningham is sales manager of the Central Station Division; and D. L. Morse is new advertising and sales promotion manager.

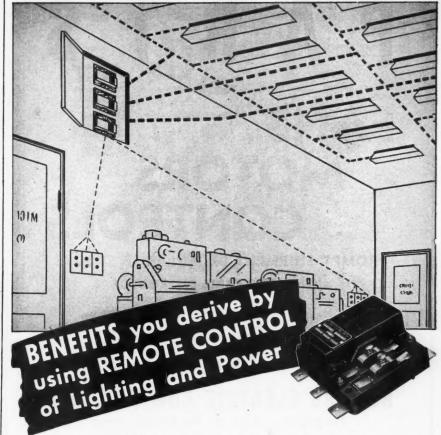
WESTINGHOUSE SUPPLY APPOINTMENTS

Appointment of William B. Meek as assistant general manager of Westinghouse Electric Supply Company has been announced. Associated with Westinghouse since 1933, Mr. Meek has served in various sales capacities in apparatus and supply and in the appliance and radio divisions. Before heading the St. Louis office, he was manager of Wesco's New Orleans branch and vice president of the Monroe Hardware Company, a Westinghouse distributor.

Company, a Westinghouse distributor. Robert P. Smith has been named manager of the Midwest District, with offices in St. Louis, succeeding Mr. Meek.

Douglass B. Williams is now manager of the East Central District with head-quarters in Pittsburgh. W. I. Bickford, whom Mr. Williams succeeds, will remain in a consulting capacity until his retirement at the end of June.

Ralph E. Lovdal has been appointed manager of the Northern District with headquarters in Milwaukee, Wis. He



- simplicity and flexibility in the design of the electrical \bullet \bullet \bullet distribution system
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VALUES you get when you use the ASCO Remote Control Switch

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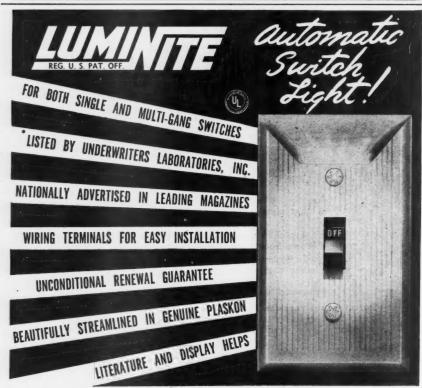
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The tiny shielded electric light is always on when the room is dark — always off when the room lights are on. Ends fumbling for switches. No more smudged walls. Single-gang, two-gang, and multi-gang assemblies available. Operates for less than 2c per year. Works also on 3- and 4-way switches. Guaranteed. For steady profits, sell the original LumiNite. List price \$1.00. Write for details.

ASSOCIATED PROJECTS CO., 80 E. Long St., Columbus 15, Ohio

succeeds Roy L. Brown who has been transferred to New York City as manager of the Eastern District.

John G. Lee has been made manager of the Sioux City, Iowa branch.

Earl E. Morton has been named appliance manager of the Northwestern District and Ray B. Mowe has been appointed manager of the branch at Fort Wayne, Ind.

Clarence G. Ward is the new manager of the branch at Peoria, Ill.

WEAVER NAMED PRESIDENT OF ANSONIA ELECTRICAL CO.

William J. Weaver, since 1942 vice president in charge of operations, was recently elected president of The Ansonia Electrical Co., subsidariary of Noma Electric Corporation. Mr. Weaver was formerly associated with the Bryant Electrical Company.

Henri Sadacca, president of Noma Electric, Charles L. Pearce and Joseph



W. J. WEAVER

H. Ward, both Noma directors, William A. Marshall, Noma vice president, and Mr. Weaver were elected directors of Ansonia.

A. P. Lunt, who has been with Ansonia since 1943 as chief engineer, was elected vice president; E. B. Anschutz, who has been with the company since 1916, was elected treasurer; and Arthur L. Corbin, of the law firm of Gumbart, Corbin, Waterous and Cooper of New Haven, was elected secretary.

GRAYBAR CHANGES

The recent return of Major Ernest R. Meserve as Eastern Division Merchandising Manager for the Graybar Electric Company, Inc. has been announced. Mr. Meserve will supervise the distribution and sale of radios and electrical appliances throughout Northern New Jersey, Connecticut and New York State with the exception of the Buffalo and Rochester territory.

Thomas J. Zeman has been appointed supply sales representative in the St. Louis office. He has been on military leave from Graybar since 1942.

COM. BARNES RETURNS TO WHEELER REFLECTOR CO.

H. Alden Barnes has returned to the Wheeler Reflector Company as vice president in charge of sales, after serv-



H. A. RARNES

ing three years in the Navy. He was appointed to rank of full Commander in July, 1945. Commander Barnes has been associated with this organization since 1919.

D. O. GRANGER NAMED SALES MANAGER OF PIERCE RENEWABLE FUSES

Pierce Renewable Fuses, Inc. of Buffalo, N. Y. has announced the appointment of D. O. Granger as sales manager. After graduating from Dartmouth Col-



D. O. GRANGER

lege, he was associated with the General Cable Corp. for 14 years in sales work in New York and Buffalo. Mr. Granger joined the Pierce organization in 1944 as sales counselor.

NATIONAL ELECTRIC CHANGES

N. L. Bost, after completing three years of Army service, has resumed his sales activities in the Pacific Northwest for the National Electric Products Corp.

SORGE TRANSFORMERS

are ECONOMICAL and CONVENIENT TO INSTALL

Mount on wall, post, or floor. No extra brackets required.

Convenient connection compartment. No extra junction boxes or fittings.

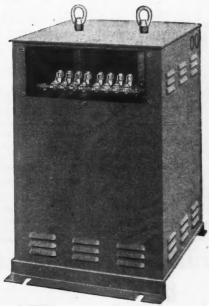
Enter primary or secondary on either side, or both on one side.

Connect to solderless terminals.

No splicing No soldering No taping



5 KVA. Wall Mounting Type



50 KVA.
Floor Mounting Type.
With cover of connection compartment removed, showing solderless terminals.

A size and type for every purpose. ¼ KVA to1000 KVA All voltages. Single phase and poly-phase.

SORGEL ELECTRIC CO., 836 W. National Ave., Milwaukee 4, Wis. Ploneers in the development and manufacturing of Air-Cooled Transformers.



performance, low replacement cost and long life. They permit easy installation in fixtures where only a limited space is allowed for ballasts. Designed by expert lighting engineers and approved by Underwriters Laboratories, "Advance" ballasts are the answer to all fluorescent lighting problems. LARGE MANUFACTURERS OF LIGHTING FIXTURES STANDARDIZE ON "ADVANCE" BALLASTS—so insist on this quality ballasts on the equipment YOU buy.

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of Pittsburgh. His headquarters is at 1049 Sixth Ave., South, Seattle, Wash.

J. Harley Sroufe, who for the past three years has been managing the company's Seattle office during the military absence of Mr. Bost, has been appointed manager of the new sales office at 1231 N. W. Hoyt Street, Portland, Oregon.

The general offices of National Electric Products Corporation will move on May 1 to the Chamber of Commerce Building, 411 Seventh Avenue, Pittsburgh, Pa.

E. E. HELM ELECTED VICE PRESIDENT

Edward E. Helm, general sales manager of the Reliance Electric & Engineering Company of Cleveland, has been elected sales vice president of the company. All other officers were re-elected. Mr. Helm has been with Reliance

since he graduated in electrochemical



E. E. HELM

engineering from Pennsylvania State College in 1924. Subsequently, he managed both the Birmingham and Philadelphia sales territory, where he was particularly active in application engineering work in the steel, textile and paper industries. His appointment as general sales manager of the company was made in December 1944.

NEW MANAGERS FOR GENERAL CABLE

General Cable Corporation of New York announces the appointment of three new managers in the New York, Washington and Atlanta districts.

Edward Kerschner is returning as Eastern district manager with head-quarters in New York City. For the last couple of years he has been head of the Contract Termination Division of the company.

A. B. Crawford has been named district manager with headquarters in Washington. He will cover the District of Columbia, North Carolina and VirTru

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The new Southern district manager is Richard Osgood, with offices in Atlanta.

He will have under his jurisdiction the states of South Carolina, Georgia, Florida, Alabama and Eastern Tennessee. Mr. Osgood was formerly advertising manager of the company.

P. D. CORNELISEN RETURNS TO CURTIS LIGHTING

Paul D. Cornelisen has returned to Curtis Lighting, Inc., after having served in the United States Navy for over three years, where he attained the rank of



P. D. CORNELISEN

Commander. He is now carrying on his duties as general sales manager. Mr. Cornelisen joined the Curtis organization in 1921, just after having been graduated from the University of Illinois.

C. D. HEPLER APPOINTED VICE PRESIDENT

Carroll D. Hepler was appointed vice president in charge of Manufacturing of the Trumbull Electric Manufacturing Company of Plainville, Conn. Mr. Hepler was recently transferred to the East from San Francisco. He joined the



C. D. HEPLER

Trumbull organization in 1928. He will continue to serve as president of the Pacific Division in addition to his new duties.

Mr. Hepler has named Willis I. Downie as manager of the Seattle plant, C. E. Barkis as manager at San Francisco and J. W. Barry at Los Angeles.



It's good business to recommend the safest wiring system for your customers—do the job with PORCELAIN Protected Wiring! This is a completely insulated system—based on using insulating (not conducting) materials for enclosures and supports.

Modern PORCELAIN Protected Wiring also offers time-

proved advantages in permanence—economy—and ablility to carry a bigger load. Only the non-metallic way has a record of fifty years of efficient, dependable service. Ask your friendly Electrical Inspector about the safety and long-life features of knob-and-tube wiring. Write for wiring catalog.



83



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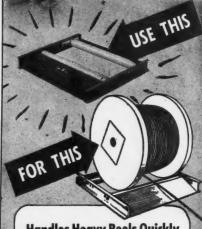
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Saves You Money!

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SYNTRON CO.

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Homer City, Pa.



Handles Heavy Reels Quickly ... Safely ... Economically

Saves time and money in the plant, warehouse or on the job.

Roll-A-Reel is the ideal way to reel or unreel wire, cable, or rope and does an easier, better job in every way.

In two sizes...2000 lbs. capacity—\$37.50 and 4000 lbs. capacity — \$75.00 F.O.B. Cincinnati.
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REPAIR

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DIAGRAMS

Save time and effort in winding and connecting jobs

Diagrams and connecting tables for laying out coils and connecting them in proper sequence for motors of from 2 to 24 poles, 2- and 3-phase

This practical manual saves your studying out connections before you begin work, and saves drawing up a new diagram every time you do a

winding job by supplying the diagrams and connecting tables for all the different kinds of windings used in motors from 2- to 24-poles, two- and three-phase. It furnishes practical, step-by-step instruction on the laying out of coils for induction-motor windings and connecting the ends of the groups of these coils in proper sequence of phase and pole groups.

Just published!

REPAIR SHOP DIAGRAMS AND CONNECTING TABLES FOR LAP-WOUND INDUCTION MOTORS

By DANIEL H. BRAYMER, Late Editorial Direction, Industrial Engineer and A. C. ROE, Manufacturing Engineer, Manufacturing and Repair Department, Westinghouse Electric Corporation

Each one of the many scores of diagrams in this manual is a practical shop drawing, marked with proper connections for the ends of all phase groups of coils so that they can be actually followed by the winder when making connections.

actually followed by the winder when making connections. The diagrams are accompanied by tables that give the number of coils in the different phase groups and the markings for the ends of these groups as indicated on the diagrams, to show the difference in markings for the ends of phase groups in different types of windings. This new, revised edition of this popular shop manual incorporates the many changes and advances in the design and construction of induction motors through World War II. The information given here may also be used when reconnecting the coil groups to satisfy changes in voltage, changes for operation on circuits of different number of phases, different frequencies or changes in the speed of a motor.

Second Edition, 387 pages, 182 figures, 52 tables, 74 Charts, \$3.50
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SYLVANIA APPOINTMENTS

Don G. Mitchell was elected executive vice president of Sylvania Electric Products Inc. at a meeting of the Board of



D. G. MITCHELL

Directors held recently. Mr. Mitchell joined Sylvania as vice president in charge of sales in 1942.

Harold P. Gilpin has been appointed assistant general sales manager of the Radio Division in New York City. Mr. Gilpin who has been with the company since 1932 was formerly manager of Equipment Tube Sales.

WAGNER ELECTRIC APPOINTMENTS

Wagner Electric Corporation of St. Louis announces branch manager and sales territory changes in its electrical sales division. The Kansas City territory has been divided into two parts. The southern portion, comprising Texas, Oklahoma and parts of New Mexico, Arkansas and Louisiana, is now the Houston branch, with sub-offices at Dallas and Tulsa, L. J. Dicianne has been appointed branch manager.

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The northern portion continues to be known as the Kansas City branch office territory and is now tied to Kansas and Nebraska and the western halves of Iowa and Missouri, with A. G. Viola as branch manager, Mr. Viola was transferred from the Pittsburgh territory where he was branch manager since 1939.

L. J. Pasher, for many years manager of the Pittsburgh Automotive Division branch territory, is now in charge of both the Electrical and Automotive Divisions there.

JOHNS-MANVILLE APPOINTMENTS

Johns-Manville Corporation of New York has announced the following appointments in its sales organization.

J. A. O'Brien, vice president of Johns-Electrical Contracting, March 1946



C. G. DANDROW

Manville Sales Corporation, a subsidiary, has been appointed manager of the power products and industrial department. He will also serve as a member of the Officers Board.

H. R. Berlin has been elected vice president of Johns-Manville Sales Corporation and is appointed manager of the building materials and general department of the company. He will also serve as a member of the Officers Roard.

C. G. Dandrow has been elected a vice president of Johns-Manville Sales Corporation and is appointed general sales manager of the power products and industrial department. He joined the organization in 1922 directly following his graduation from the Massachusetts Institute of Technology.

AIREON Appointments

Arthur E. Welch has been elected vice president in charge of sales of the Aireon Manufacturing Corporation, Kansas City, Kansas. He was formerly vice president and treasurer.

Walter A. Bowers has been elected vice president and treasurer. He was



A. E. WELCH

formerly with the Lawrance Aeronautical Corporation of Linden, N. J.

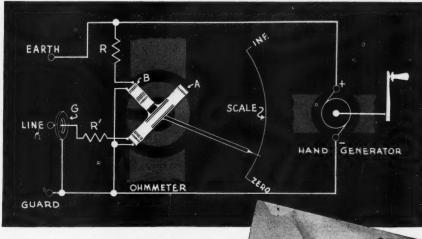
C. E. Cook has been named to head the new Circuit Breaker Division. He goes to Aireon from the Square D Company of Detroit where he was field engineer and assistant sales manager.

Electrical Contracting, March 1946

Here's why-



"MEGGER"* Insulation Testers are always dependable—



In what we term a cross-coil true ohmmeter, two coils are mounted in fixed relation to each other on the same pivot-and-jewel moving system in the field of a permanent magnet. "Current" flows in coil A and "potential" in coil B, and they are connected so that their respective torques oppose each other. Since there are no control springs, the opposing coils give a true ratio of E/I, and ohms (or megohms) are indicated by a pointer over a scale. The readings are independent of the voltage of the hand-driven d-c generator, because any change in the voltage affects both coils in the same proportion.

The "Megger" instrument is simplicity itself. The circuit diagram shows all elements—hand-cranked generator, fixed resistance coils and ohmmeter with pointer and scale. Nothing more is needed and nothing could be simpler. In making resistance tests, you merely connect leads from the instrument to the apparatus or circuit under test, turn the crank for a few seconds, and read the insulation resistance directly on the scale.

Power generation and distribution practice has dictated certain standards of quality and performance that every piece of electrical equipment is expected to meet. "Megger" insulation testing instruments have been and will continue to be built in conformity with these high standards.

For complete descriptions and applications of all types of "Megger" Insulation Testers write for Catalog 1685-EC.

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APPOINTMENTS

Fred C. Walter, who has been associated with the sales, advertising and product development of The Formica Insulation Company in Cincinnati, has been named assistant sales manager of the company.

Formica has opened a factory branch office in Philadelphia with Albert Lesberil as branch manager. The Atlanta territory has been combined with that of Charlotte, N. C. with offices in both cities. Clarence Kuester who had been associated with his brother, Fason Kuester, in charge of the Charlotte office is moving to Atlanta to take charge of the Formica sales work in the Georgia area.

Kenneth Pitt, until recently associated with the Formica home office and plant purchasing department, has gone to Boston to become affiliated with Francis Murdock, Boston representative.

KELLOGG ELECTS NEW OFFICERS

James H. Kellogg, vice president, secretary and works manager of Kellogg Switchboard and Supply Company, Chicago, was elected president of the company succeeding his father, James G. Kellogg, at a special meeting of the



J. H. KELLOGG

board of directors in January. At the same meeting Mr. Kellogg, Sr., was elected chairman of the board.

Other new officers of the company are Harry C. McCluskey, former treasurer, who is now executive vice president and treasurer; Claude D. Manning, formerly assistant to the president who is now vice president and secretary and Harvey O. Edison, who was made assistant secretary and assistant treasurer.

NEW SALES REPRESENTATIVES FOR MOE-BRIDGES CORP.

The Moe-Bridges Corporation of Sheboygan, Wis. has announced the appointment of the following sales representatives.

J. Paul Lumpkin with offices at 248 Tranquil Avenue, Charlotte, N. C. will





A small quantity applied to the joints to be soldered will, WHEN HEATED, flow and unite the parts the same as wire and bar solder No flux or solder-ing iron required. (Priority A-7 or bet-ter) 25c tubes; 1, 5, 10 and 25-lb. cans.

L. S. BRACH Mfg. Corp. 200 Central Ave., Newark, N. J.



cover North Carolina, South Carolina and Eastern Tennessee.

Verlyn H. Branham with headquarters at 160 Interlochen Drive, N. W., Atlanta, Ga. will cover the states of Georgia and Alabama.

Theodore M. Gage Company, located at 1900 Euclid Building, Cleveland, will be responsible for the Ohio territory.

E. L. TAYLOR BECOMES PARTNER IN CAMFIELD MFG. CO.

Edward L. Taylor has been elected to partnership in the Camfield Manufacturing Company, Grand Haven, Michigan,



E. L. TAYLOR

of which he is general sales manager, it was announced by Russell W. Camfield, president.

Two plants are operated by the company in Grand Haven.

Republic Steel Corporation has announced the appointment of Harvey A. Craig as Pacific manager. In this new post, Mr. Craig will supervise the territory served by all three Coast sales offices. He will, however, retain his position as manager of the Los Angeles office. No change is being made in the personnel of the other offices. W. L. Thomas is district sales manager of the San Francisco office and C. V. Gardner is district sales manager of the Seattle office.

American Transformer Company of Newark, N. J. announces the appointment of Cooper-Di Blasi as representatives for Metropolitan New York and lower New York States. Their headquarters are at 259 West 14th Street, New York.

Weston Electrical Instrument Corporation of Newark, N. J. has appointed Russell Ranson, 116½ East Fourth Street, Charlotte, N. C. as sales representative for Virginia, North Carolina and South Carolina.

Electrical Contracting, March 1946

In the RED PLASTIC Can IT LEADS THEM ALL



Pat. Nos. 2200443-2228210

Locks Out ... Resets AUTOMATICALLY

- 1-Positively cuts out deactivated, flickering, blinking lamps.
- 2—When trouble is detected the starter automatically cuts off current to the ballast and lamp.
- 3—Gives long life to ballast because defective lamp is locked out. Prevents overheating.
- 4—When Lloyd AUTOMATIC locks out defective lamp—turn off the current—Remove defective lamp—Put in a new lamp.
 - Allow at least one minute to make the above change of lamps. Turn on the current. The starter automatically lights the new lamp.
 - NO NEED TO DO ANYTHING TO THE STARTER
- 5—Lloyd NEW PLASTIC CAN has higher dielectric strength, is stronger, lighter, distinctive.
- 6—Knurled rim on plastic can insures positive grip for insertion and removal of starter.
- 7—Plastic can is sealed. No projecting lugs to cause trouble.
- 8—The life of the AUTOMATIC starter is many times greater than that of the average lamp.
- 9—It saves maintenance costs and power consumption, protects and insures longer life to the ballast and lamp.
- 10—Tested in production and prior to shipment to insure perfect performance.

Lloyd Automatic Available in FS-40 and FS-100 LLOYD PRODUCTS COMPANY

Dept. EC-3

Representatives in 23 Leading Cities—Export Office: 13 E. 40th St., N.Y.C.

CUT ANY SIZE HOLE IN METAL-WOOD-PLASTICS

One Bruno Adjustable Hole Cutter replaces many fixedradius cutters. High speed steel blade cuts clean, fast holes. Fits drill press, portable drill or hand brace. Easily set for any diameter from %" to 1\2" or 1" to 2\2". Ask your jobber, or write Bruno Tools, Beverly Hills, California, Dept. EC-3

Model No.	Shank Size	Cutter Expansion Capacity	User's Price		
100	¾" straight shank	%"- 11/2"	\$2.95		
100-B	Square Bit Stock	56"- 11/2"	\$2.95		
101	¾" straight shank	1"- 21/2"	\$4.95		
101-B	Square Bit Stock	1"- 21/2"	\$4.95		





IMPORTED SWISS 5-RANGE, CENTRIFUGAL TYPE HAND TACHOMETERS

CATLG. NO. 303 30-120 RPM 100-400 RPM 300-1200 RPM 1000-4000 RPM

3000-12,000 RPM

CATLG. NO. 346 120-480 RPM 400-1600 RPM 1200-4800 RPM 4000-16,000 RPM 12,000-48,000 RPM

FOR DETAILS WRITE FOR BULLETIN NO. 750. NO PRIORITY REQUIRED

HERMAN H. STICHT CO., INC. 27 PARK PLACE NEW YORK N.Y.

Climax Engineering Company of Clinton, Iowa, has announced the acquisition of exclusive manufacturing and selling for "Roto Beam" radiant air circulators.

W. F. Benson has joined Federal Electric Products Co., Inc. as district sales representative in the Michigan area.

Russell & Stoll Company, Inc. of New York, announces the appointment of Wagner-Green Company as northern Ohio representatives. Their offices are located at 1935 Euclid Ave., Cleveland.

Thermador Electrical Manufacturing Company of Los Angeles, Calif., announces the appointment of Frank A. Ballman as general sales manager. He was, until a short time ago, a Major in the Army Air Forces.

Melvin C. Shaw has been named manager of the blower and compressor department of the Allis-Chalmers Mfg. Co., Milwaukee, Wis. He succeeds John Avery, who has resigned to become president of a blower corporation.

The Okonite Company, Passaic, N. J. has moved its district office in Cleveland, Ohio to the Engineers Building, Cleveland. F. J. Dahleiden will continue in charge of the office which he has managed since its establishment in 1939.

Ideal Commutator Dresser Company of Sycamore, Ill. has changed to a corporation to be known as Ideal Industries, Inc. There has been no change in management, personnel, location, manufacturing or method of distribution.

The Crocker-Wheeler Division of Joshua Hendy Iron Works, Ampere, N. J. has announced the appointment of I. C. Smith as chief engineer of the company.

Jack F. Whitaker has been made vice president, in charge of manufacturing, of the Whitaker Cable Corporation, Kansas City, Mo. He has been with the organization since 1927.

The Advance Transformer Co. of Chicago has moved to new and larger quarters at 1122 W. Catalpa Avenue.

How to select • operate • maintain the right controllers for your electric motor power

Here is your controller guide for selecting and using the control apparatus that will best harness your electric motor power to your load requirements. This book takes the guess-work out of control purchase and presents the operator with all the facts on controller operation and design. Hundreds of diagrams, illustrations, curve charts and tables, together with a simple, direct text, instruct operating men, engineers, purchasers of controls on each detail of proper selection, operation and maintenance.

CONTROLLERS FOR **ELECTRIC** MOTORS

By HENRY DUVALL JAMES Consulting Engineer, Pittsburgh,

and Lewis Edwin Markle Design Engineer 324 pages, 6½ x 9¾, 276 figures, 6 tables, \$3.50



This book brings you up to date on the latest control apparatus—new uses of the electron tube, magnetic contactors, time-limit method of acceleration, development of plugging control, and of the Regulex, Ampledyne and Rotorol, and new types of time-delay overload relays. Here is analysis of popular commercial types, and most successful methods of accelerating motors, speed control, mechanical and dynamic braking, regenera-tion, and voltage control for d-c motors, with special sections on protective devices, national codes, installation and maintenance, and future control developments.

Detailed information on:

Functions, types, advantages and limitations of magnetic contractors
De-ion principle of arc rupturing
Use of two power tubes to give more uniform d-c power
Time-limit methods of accelerating motors
Motor-generator control of motor voltage
New types of time-delay overload relays

• There is a section on how to read controller diagrams, and a section devoted to future control developments describes new developments from World War II, electron-tube control, variable frequency, hydraulic gear, the use of telephons devices and practice, radio signals, etc.

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W. D. Barnes and John W. Stewart have been appointed sales representatives on the Pacific Coast for both the Essex Wire Corporation, and the Paranite Wire and Cable Division, Ft. Wayne, Ind. Mr. Barnes has his office at 55 Montgomery Street, San Francisco and Mr. Stewart is located at 1032 Rowan Building, Los Angeles.

Aerovox Corporation New Bedford, Mass. has announced the appointment of Vernon L. Haag as a vice president. Mr. Haag was formerly with the Illinois Watch Case Company.

L. S. Brach Manufacturing Company recently moved into its new plant at Central Avenue, Hoyt and Bleeker Streets, Newark, N. J.

Joseph E. Chassaing, Jr., has been appointed assistant midwestern sales manager for The Art Metal Company of Cleveland.

Star Electric Motor Company of Bloomfield, N. J. has opened a New England district office at 1430 Massachusetts Avenue, Cambridge, Mass. Elliot W. Knight has been appointed district manager.

M. N. Kenneally has been appointed sales manager of the Joslyn Manufacturing and Supply Company of Chicago, Ill.

Insl-x Co., 857 Meeker Avenue, Brooklyn, N. Y. announces the appointment of Don Weir as sales manager and B. B. Schneidermann as technical service manager.

Lester Haft announces the formation of a new company known as Haft & Sons, Inc. The company will specialize in the manufacture of cord sets and electrical wiring devices, with headquarters at 79 Third Street, Brooklyn, N. Y. For the past 30 years Mr. Haft has been treasurer and general manager of the C. D. Wood Electric Company.

Progressive Welder Company of Detroit, Mich. has appointed William H. Marion as representative. He has offices at 320 Ontario Street, Toledo, Ohio.

Electrical Contracting, March 1946

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5-WAY BETTER PERFORMANCE

Better . . . 5 ways better! Five engineering improvements in the design and construction of Royal-Noark Non-Renewable Fuses mean that they stay cooler . . . give greater protection to vital equipment. Complete detailed catalog information is yours on request, and prompt deliveries on your orders.

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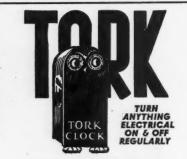
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place. Assembly is then ready for installation. Connect incoming wires and place in

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This WHERE TO BUY Section

supplements other advertising in this issue with these additional announcements of products and services essential to efficient and economical operation, maintenance and service. Make a habit of checking this page, each issue.

Departmental Staff, ELECTRICAL CONTRACTING

NEW FRONTIERS IN ENGINEERING [FROM PAGE 591

series capacitors may be allowed to handle momentary currents which are twice their continuous current rating. However, in most circuits to which series capacitors are applied the currents which flow during fault conditions are considerably more than twice the maximum working current. For this reason it is necessary either to use capacitors with a continuous current rating equal to one-half the maximum current which may flow during a fault or to use a voltage limiting device.

The fundamental protected series capacitor circuit consists of a series capacitor shunted with a gap. If, however, this is a metallic gap which has a high arc voltage and a restriking arc. the series capacitor will be subjected to high currents while the arc exists in the gap.

The use of a gap having special graphite electrodes gives a low arc voltage and limits the current flowing in the series capacitor leads to a low valve. Even with graphite electrodes, however, the arc will be moved out of the space between the electrodes by magnetic forces, thermal air currents, and random air currents unless special precautions are taken in the gap design.

As the spacing of a gap is decreased, the variation in breakdown voltage on successive operations becomes greater. For dependable operation a gap should be adjusted to break down at not less than 300 volts. Since the gap must function dependably at no more than twice the rated capacitor voltage, it cannot be used to protect a capacitor rated at less than 1500 volts unless an auxiliary means is provided to ionize the gap when the capacitor voltage reaches twice the rated value.

A by-pass switch is designed to meet the following requirements:

1. It must close rapidly enough to protect the gap from overheating during any fault up to 2500 amperes.

2. It should have sufficient time delay on closing in order that any capacitor bank up to 180 kva. at 230 to 2400 volts would be substantially discharged through the gap before the contacts

The motor element must not be damaged by the maximum combined fault current and capacitor discharge current.

4. It must have sufficient time delay on opening to allow a fault to be cleared by the line breakers so that no holding arrangement is required.

A thermally actuated toggle switch which has quick-make and quick-break

action was developed for this purpose. The bellows is evacuated and charged with a small quantity of a liquid having a low vapor pressure at any ambient temperature which may be encountered in service. At such temperature the bellows remains collapsed because of external atmospheric pressure. When mounted in the switch, it is stretched to the normal length and exerts a pull more than sufficient to open the switch mechanism. When gap current passes through the walls of the bellows, heating occurs which changes the vapor pressure of the enclosed liquid. Continued heating causes the vapor to exert a pressure sufficient to acauate the toggle mechanism causing the switch to close.

The closing of the switch by-passes the entire series capacitor and thus terminates the flow of gap current and allows the bellows to start cooling. Cooling causes the vapor to recondense, and the resulting differential pressure reopens the switch and restores the series capacitor to service.

Industrial Application of Rototrol Regulators

The Rototrol has been applied in considerable numbers to a wide variety of industrial applications.

It is essentially a dc. generator but with a number of field windings which are designed and connected in various ways depending on the regulating problem. The Rototrol functions entirely through the interaction of these fields, and has no moving parts or circuits which require delicate adjustment for proper operation or to compensate for wear. After initial adjustment during installation, no further attention is required other than the routine maintenance associated with a dc. machine of similar size. The Rototrol is driven at constant speed by a small squirrel cage induction motor or may be a part of the motor generator set or exciter set of the adjustable voltage drive it serves.

The principal elements are a self-energizing field and the separately excited control fields. One of the control fields is commonly referred to as the pattern field and is excited from a constant potential source. The other control field measures the quantity to be regulated and is commonly referred to as the pilot field. The pattern and pilot fields are usually connected with their ampere turns in opposition so that the pilot field measures the quantity to be regulated and compares it with the pattern field. Any net difference in these fields will cause the Rototrol to exert corrective forces to reduce the difference so that



Electrical circuits that run around boiler rooms, steam tunnels, soaking pits, pouring ladles and other hot spots are bound to fail frequently unless cable insulations can withstand high operating temperatures. One of the safest ways to provide uninterrupted electrical service in these torrid zones is to protect with Deltabeston Asbestos-insulated Power and Motor Lead Cables. These heat-resistant cables have proved in countless installations that the asbestos-insulation just won't bake out despite constant, high heat.

most corrosive

High Heat

If excessive heat is causing frequent power failures in your mill, investigate G-E Deltabeston Asbestos-insulated Cables now. Deltabeston is used extensively for power, lighting and control circuits especially where severe operating conditions prevail. General Electric manufactures a complete line of asbestos-insulated cables including many special designs. They're constructed not only to withstand excessive heat but high humidity, oil, grease and most corrosive vapors.

For additional information write to Section Y-364-8 Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn. Deltabeston Wires and Cables are distributed nationally by Graybar Electric Co., General Electric Supply Corp., and other G-E Merchandise Distributors.

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TIME SWITCHES—FLASHES

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the pattern and pilot fields balance out when the quantity under regulation is at the proper value.

The counter E.M.F. type of speed regulator circuit is perhaps the most widely applied. Representative applications are feed drives for machine tools, adjustable voltage planer drives, high speed adjustable voltage elevator drives, skip hoist drives, and supercalender drives. It is applied where wide speed ranges are required with good speed regulation at all speeds, particularly at the minimum speeds. The circuit does not require a pilot generator to measure the motor speed which results in a space saving about the machine and in a simplification of the electrical equip-

On applications where it is desirable to hold the speed of the driving motor within very close limits, a pilot generator for measuring motor speed directly is used in conjunction. Typical applications of this type of speed regulator include drives for paper machines, wind tunnel propellers, and dynamometers.

ment and circuits.

In the steel, textile, paper and rubber industries, there are a large number of wind-up and unwind operations utilizing core type reels. A drive for such a reel must maintain constant tension in the strip and must continually and smoothly change its speed as the roll builds up from a small core to a full roll. A number of Rototrol controlled drives for this service have been applied. The Rototrol is used in conjunction with an adjustable speed, direct current motor which has a speed range by shunt field control equivalent to the ratio of the full roll diameter to the empty core diameter.

Coordinated Electric Drive Rubber Calender Train

The continuous process of coating fabrics with rubber, such as is used in tire manufacturing, involves several individual machines that present operating problems not successfully met by mechanical drives. A new, coordinated electrical drive has been developed which does meet these requirements using amplidyne, and also electronic, control.

With the electrical drive, the entire train is sectionalized so that each auxiliary is provided with its own motor. Coordinated control takes the place of the line shaft tie and, in addition, provides the proper tensions and speeds. Furthermore, once optimum adjustments have been established, the control holds them there. Electrical instruments make it possible to take measurements and record the adjustments. Thus,

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if that same run is to be repeated in the future, the best operating conditions can be obtained very quickly.

The various pushbuttons and rheostat dials which are used for the adjustments are located remotely from the driven auxiliaries, in convenient groups.

The main drive for the calender is of the adjustable voltage (Ward Leonard) type, providing ten to one speed range, of which five to one is by armature voltage control and two to one by motor field control.

The group of drives which is called the "central auxiliaries" always operates at the speed of the calender. They are not, however, supplied from the calender generator. The auxiliary motors themselves are much smaller than the calender motor so that their IR drops are considerably higher. Thus, at 1/10 speed the terminal voltage that they require would be substantially more than what would be available from the main generator and a booster would have to be used to overcome this.

The power circuits for both the entry and the delivery auxiliaries are treated in the same manner. In either group the individual drives always operate together. They must be separated from the central auxiliaries and the calender, because of the roll-changing requirements. They are stopped for roll changes while the calender is running, restarted, and then temporarily overspeeded to restore the amount of stock in the festoons to normal.

The driving motor of the large m-g set is a 450 hp., unity power factor synchronous machine, supplied from a 2300 volt source. A switchgear type controller is furnished for this motor. There are also about 24 devices such as motors, solenoids, valves, which operate from a 440 volt supply. These are controlled and interlocked with the d-c equipment.

The motors involved include those for ventilating fans in the cementer, cement pumps, calender lubricating pumps, water pumps for the cooling drums, feed conveyors for the rubber banks in the calender, and also the driving motors of the small motor-generator sets used for the train drive. Interlocking between these units and the d-c control is very important. For example, in case of a loss of lubrication, the calender must be shut down promptly. If ventilation is lost in the cementer, this must also be done.

The calender running speed, acceleration rate, and tensions are preadjusted, so that the operator only has to push a "Run" button and the entire train accelerates to the predetermined speed. This may be done only from one central point, the main desk.

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Position open in large industrial organization. Opportunity for man with substantial background of electrical construction and estimating experience on industrial work. State education, experience, and salary required in first letter. Location, Michigan.

Michigan.
P-366, Electrical Contracting
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RW-364, Electrical Contracting 330 West 42nd St., New York 18, N. Y.

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Specialists in

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Let us be your small-motor department.

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I-Federal P-4, 12" throat air operated 700 KVA capacity welder

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Louis Allis Frame 225, 220V.-60 Cy.-3 Ph. 1800
R.P.M. Splash proof. Ball Bearing. Double End
Shaft. Tropical Ins. Price each, F.O.B. \$82

MOTORS, GENERATORS, TRANSFORMERS

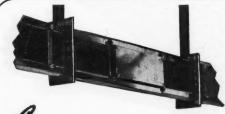
ELECTRIC EQUIPMENT CO.

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Compare ...this Square D Saflex Feeder Duct performance with other Duct

Temperature rise 50% lower than for other totally-enclosed busses of equal copper cross-section and rating. Balanced voltage drop of only 1.8 volts per 100 feet.



SAFLEX PLUG-IN DUCT... Running
Mate for Saflex Feeder Duct

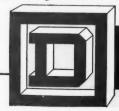
Permits plugging in machines where and when you want them. Units are easily attached and disconnected. 100% salvage for re-use.

All Feeder and Plug-In Duct is NOT pretty much alike...

Performance, not Original Cost, is the prime factor in choosing the right duct...

You have a right to expect the duct you install to pay its own way in terms of the flexibility and increased efficiency it provides. Any good duct will do that. But a careful inspection of SAFLEX DUCT will prove that there's a vast difference in the degree of efficiency.

Any duct installation represents a fairly substantial investment . . . substantial enough to justify thorough comparison before selection. We not only welcome such a comparison—we urge it.



SQUARE D COMPANY

DETROIT

MILWAUKEE

LOS ANGELES

A NEW CABLE FOR HOMES AND FARMS



PREGISTERED TRADE MARK

NON-METALLIC SHEATHED CABLE with Thermo-plastic Insulated Conductors

ADVANTAGES

- 1 Small overall diameter—easy to handle. Requires smaller holes
- 2 Lighter weight-Facilitates handling during installation
- 3 Type T conductors—Insulated with long-life, thermo-plastic com-
- 4 Small diameter of conductors-Requires less space in outlet boxes
- 5 Positive conductor identification—Insulation has permanent color
- 6 Conductor insulation—Resistant to oils, acids and alkalies
- 7 Insulation and braid-Both are flame- and moisture-resistant
- 8 Improved braid finish-Smooth, non-tacking and non-marking
- 9 Free-stripping-Braid, paper armor and insulation all free-stripping
- 10 High rating-Approved for 60 degree C operation

Use this new Underwriters' approved cable for wiring homes, farm buildings and other small buildings. You'll find PVX easy to install. It has small diameter and is light weight. It can be depended upon to give long service. PVX has Type T conductors insulated with thermoplastic compound. This insulation is resistant to oils, acids and alkalies. Improved crushed paper armor protects the conductors and overall is a flame- and moisture-resistant braid. PVX is available in sizes 14 to 4 without ground wire.

FOR FURTHER INFORMATION see the nearest G-E Merchandise Distributor or write to Section W361-8, Appliance and Merchandise Dept., Bridgeport, Conn.



GENERAL @ ELECTRIC